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ABSTRACT

This document contains the four state-of-the-art papers that serve as planning materials for construction of the planning guide for the project, Accessibility to Vocational Education Programs and Facilities for Handicapped Persons. The first paper suggests techniques by which school administrators can identify barriers to vocational education programs faced by handicapped persons. Sixteen techniques are described and their strengths and weaknesses discussed. The second paper identifies and describes group techniques for generating strategies to overcome barriers to vocational education for the handicapped. Five techniques are described in detail and their strengths and weaknesses considered. The third paper identifies procedures for use in estimating costs and allocating resources within the context of the legal and policy directives of the Vocational Education Amendments, Section 504 of the Rehabilitation Act, and P. L. 94-142. Primary focus is on costing and resource allocation to remove barriers to program accessibility. The fourth paper identifies and discusses federal guideline documents available to local school administrators in addressing accessibility. (YLB)

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ATTACHMENT B

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"Accessibility to Vocational Education Programs and Facilities For Handicapped Persons"

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This document contains the four state-of-the-arts papers that serve as planning materials for construction of the Planning Guide for the project, "Accessibility to Vocational Education Programs and Facilities for Handicapped Persons." These materials are interim products of the project and suggest those materials and procedures that are being refined for inclusion in the Guide. In order of appearance, the papers are:

1) TECHNIQUES FOR THE IDENTIFICATION OF BARRIERS TO VOCATIONAL EDUCATION FOR HANDICAPPED PERSONS

2) MAKING VOCATIONAL EDUCATION ACCESSIBLE TO HANDICAPPED STUDENTS: GROUP TECHNIQUES FOR CHOOSING WAYS TO REMOVE BARRIERS

3) COSTING AND RESOURCE ALLOCATION

4) GUIDELINES DOCUMENTS ON ACHIEVING ACCESSIBILITY: FEDERAL LEVEL

The principal author of each paper is listed with the cover sheet of each paper. It is noted that the entire project staff contributed to each paper.

E. Rice 1979

TECHNIQUES FOR THE IDENTIFICATION OF BARRIERS TO VOCATIONAL EDUCATION FOR HANDICAPPED PERSONS

by

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I. INTRODUCTION

In recent years, Congress has passed legislation that will change the delivery of vocational education to special needs populations. Public Law 94-142, the Education for All Handicapped Children Act, provides for a free and appropriate public education program for all handicapped students. Section 504 of the Rehabilitation Act of 1973 mandates that all school systems make their facilities and programs accessible to handicapped students. In addition, two other significant legislative efforts, the Vocational Education Act of 1963, as amended by the Education Amendments of 1976 (P.L. 94-482) and Section 503 of the Rehabilitation Act of 1973, offer added incentives to school systems to prepare the handicapped for employment.

In an effort to comply with these laws, school systems must identify the barriers to their programs faced by handicapped persons. A barrier is a characteristic of an educational delivery system which functions to inhibit or prevent its use by the handicapped. In general, there are two kinds of barriers, those that are objectively defined and those that are perceived. An example of an objectively defined barrier is a doorway in a corridor which is not wide enough for a handicapped student in a wheelchair to pass through. This is a barrier which can be identified by applying highly specific criteria. Perceived barriers are more subjective and vary according to who is considering them. For example, to one vocational instructor, a piece of equipment might seem too hazardous for a partially-sighted individual to operate. Another instructor, on the other hand, may not perceive the same hazard and allows partially-sighted students to operate the machinery. Similarly, a lack of appropriate equipment, materials or supplies may be perceived as a barrier by one instructor or administrator but not by others. Handicapped persons, themselves, may perceive barriers which have not been identified by objective means. For example, a handicapped student may find a particular program or course inaccessible because transportation is unavailable at that time. Although this constitutes a definite barrier to the program, it may not have been perceived as such by the administrator. To the degree either type of barrier functions to inhibit participation by persons with handicapping conditions, it is a barrier.

Clearly, in order to ensure accessibility to vocational education for the handicapped and design programs to meet this objective, a school system must first identify barriers. Identified barriers will have an enormous impact on the entire planning process--determining the procedures for removing the barriers, developing comparative cost estimates, and evaluating whether or not the barrier has been removed. Although it is possible to compile here a lengthy list of known barriers, it would be impossible to include all barriers since each school system may contain some which are unique to it. Thus, it may be more valuable from the point of view of the school administrator to have at his or her disposal a method or technique to identify both the objectively defined and perceived barriers peculiar to that school system.

Goals and Objectives

It is the purpose of this paper to suggest techniques by which school administrators can identify the barriers to vocational education programs faced by handicapped persons. The paper's objectives are four-fold: (1) to indicate the relationship of barrier identification to program planning; (2) to review recent literature related to identifying barriers to vocational education; (3) to describe and evaluate techniques that have been used to identify barriers; and (4) to discuss techniques that have potential use for barrier identification.

II. METHODOLOGY

The literature search began with a broad survey of general information about barriers and narrowed to an examination of specific techniques by which barriers could be identified. Methods and procedures used in identifying barriers to the handicapped in vocational education as well as information relevant to identify the needs of special populations were collected. Since only a few specific techniques were identified as having been used in special education and vocational education, other fields were investigated to locate potentially useful techniques. These other fields included: rehabilitation counseling, educational administration, mental health

administration, management sciences, public administration, business management and administration, vocational rehabilitation, psychology, organizational behavior, political science, sociology, architecture and planning.

The reivew of the literature began by using automated searches in ERIC (Research in Education and Current Index to Journals in Education), SSCI and AIM/ARM with the following descriptors: career education, vocational education, vocational rehabilitation, pre-vocational education, special education, handicapped, mental retardation, learning disabilities, developmental disabilities, accessibility, architectural barriers, barriers, teacher attitudes, community attitudes, admissions criteria, stereotypes, peer acceptance, and instructional (ADJ) methods. These searches were supplemented by a hand search to find related journals, books, articles, and government documents. Approximately 350 citations were identified as relating to the topic and of these, approximately 100 contained significant information.

After appropriate techniques were identified, they were pursued individually within the literature. This was accomplished by examining the major articles and books available on each technique. The sources included were CIJE, Psychological Abstracts and Social Sciences Citation Index. Journals particularly concerned with the topics of handicapped persons, special education and vocational education were reviewed by issue from 1970 to the present (Exceptional Children, Journal of Special Education, Rehabilitation Counseling Bulletin, Rehabilitation Literature, American Vocational Journal, Journal of Rehabilitation, Teaching Exceptional Children, Journal of Industrial Teacher Education).

Consultants and experts were used to gather additional information about a particular technique. Consultants having experience in the issues of mainstreaming and accessibility were contacted to determine successful procedures used in their efforts. Since other techniques used in health administration, political science, business, public administration and architecture were identified, experts representing various disciplines were interviewed as to the use and potential application of these techniques to the specific issue of barrier identification in vocational education.

Other sources examined were state and national organizations directly concerned with the issue of accessibility. Publications and newsletters such as Insight (Council of Exceptional Children) and Newsnotes (National Association of Vocational Education--Special Needs Personnel) were used to identify projects and programs working on the issue of barriers. Several of these model vocational education programs involving the handicapped were contacted and provided information concerning specific methods of identifying barriers.

Of approximately 30 techniques reviewed in the course of the literature search, 15 were selected to be examined in detail for this paper. (The rejected techniques are listed in Appendix A.) Several guidelines were followed in this selection procedure. First, each technique must have received adequate research--at least three major sources had documented its effectiveness, validity and reliability. Secondly, the technique had to be applicable to the field of education and, more specifically, to the problem of identifying barriers. Those already used for the purpose of identifying barriers were collected as well as those borrowed from other fields exhibiting potential usefulness. Thirdly, the technique had to be relatively easy to use. Techniques requiring special hardware, highly complex administrative skills, excessive resources in terms of time, personnel and cost were eliminated. Fourthly, the technique had to allow for the involvement of those providing vocational education and, more importantly, the consumers of these services. Only those techniques which would allow for the primary involvement of handicapped students who have been or will be enrolled in vocational education programs and their parents, were considered. The participation of such decision-makers as administrators, educators and personnel who provide vocational education to the handicapped students was assumed. It is only by involving both groups and applying the unique perspectives of both to the problems of accessibility that barriers can be understood.

III. STATE OF THE ART: BARRIER IDENTIFICATION

As has been shown, the law states quite clearly that vocational education programs must be made accessible to handicapped persons. It is also clear that in order to comply with the law, school administrators will have to identify the barriers in their programs which prevent the handicapped from benefitting from them. The purpose of this section is to review the literature pertinent to this issue of identifying barriers.

The problem of barrier identification presupposes knowing what constitutes a handicap. The school administrator, after all, cannot begin to identify the barriers facing handicapped students until she/he knows which students are handicapped and what handicaps they have. And yet the literature points to the fact that even this critical knowledge is often limited.

The U.S. Office of Education has specified nine handicapping conditions to be used in determining eligibility for special assistance (Federal Register, 1977). However, individual states offer somewhat different definitions. This lack of agreement perhaps contributes to some confusion. There is also some ambiguity in applying these definitions. Carlson (1978) explained why only 1.7 percent of vocational education students were characterized as handicapped. The statistic, he said, was somewhat misleading since many disabled students are assimilated into vocational education programs but are not counted as "handicapped." He further stated that only if special services were required for a student to succeed in a program were they tallied as handicapped persons. In some areas, stereotypes are still used to define handicaps. One vocational education administrator from a large city school system wrote:

> "The available handicapped pupil is a mentally retarded or multiply handicapped pupil. The stereotype is of a deaf, blind or crippled child. However, these constitute only about one-third of the actual population of handicapped, and they are the third that is easiest to integrate." (Bergman, 1975)

If there has been and continues to be some confusion about what is a handicap, the impact of some attempts to define barriers has also been confusing. There have been many excellent attempts to define barriers and

to fit them into categories, and yet they have not always agreed. In 1977, for example, Phillips, Carmel, and Renzullo developed an informative publication about the issue of vocational education for the handicapped student. In a section entitled, "The Barriers," the authors described their "observations" concerning the barriers that exist in the educational system. Recognizing the impossibility of separating the barriers into distinct categories since many overlap, they offered three broad groupings to help conceptualize these barriers. The first category, "Barriers Within Society," included: lack of knowledge or awareness of needs and problems of handicapped individuals; attitudinal, architectrual and media barriers; inadequate laedership and employment barriers. The second category was called "Barriers Within the Helping System," which encompassed legislation, lack of knowledge about the helping system, inadequate planning, labeling, personnel, preservice and inservice education, vocational instructional services, counseling and placements, research on vocational materials and equipment, minority handicapped persons, and delinquency and crime. A third category, "Barriers Within Handicapped Persons, Their Families and Other Advocates," includes barriers within these groups such as physical, mental, emotional problems, attitude, behavioral difficulties and problems of competition, knowledge and skills of advocates.

In another attempt to define barriers, Leslie Park (1975) offered general definitions of barriers to "normality" for the handicapped person. His discussion of problems and barriers included (1) what he termed "a confused value system" within the government and society; (2) the lack of a system of preparation and entry into the world of work for adolescents; (3) the lack of appropriate training for existing jobs; and (4) the current state of technology which could be but is not being used to assist handicapped persons.

Two federally-sponsored meetings also tackled the issue of defining barriers. In November 1976, the President's Committee on Employment of the Handicapped convened to discuss the barriers to employment of handicapped persons. Two hundred leaders representing industry, vocational rehabilitation, employment security, education and consumer groups attended this meeting and

set forth a list of barriers and recommendations in a publication entitled "Pathways to Employment." The issue of employment was also the topic of the White House Conference on the Handicapped in May, 1977, which met to discuss the barriers which prevent or limit the participation of handicapped persons not only in employment but in society in general. Predictably, perhaps, hundreds of barriers were listed at these two meetings; some, to be sure, were common to the other studies mentioned, but others were found no where else in the literature and were grouped in different categories.

A further source of confusion derives from studies which emphasize different barriers as the most serious. In a comprehensive survey of the needs of the severely disabled, Revis and Revis (1978) cited transportation as the most frequently reported need. On the other hand, Leonard (1978) in an article entitled, "The Handicapped Building," contended that the impact of architectural barriers is limitless. He wrote that barriers imposed by architectural design are reponsible for a majority of the problems facing handicapped persons because of the intense environmental frustration they create. Gollay and Doucette (1978) pointed out that the major discussions of barriers usually address architectural barriers. They suggested that the administrative and social barriers facing students with <u>all</u> disabilities were of primary importance to consider. These included the issues of stereotyping, conflicting regulations and lack of adaptation and development of instructional methods and procedures. A review of the literature reveals, therefore, a lack of consensus not only about what <u>are</u> barriers but also about which barriers deserve most attention.

Another characteristic of the literature devoted to problems of accessibility is its generality and lack of helpful specificity about how school administrators can open their programs to the handicapped. According to Carlson (1978), the message of the 1976 Amendments was very clear--"open the vocational education system to all who can profit from it and prioritize by need." The major dilemma facing vocational educators is how to achieve such an open system. But as Carlson noted, the question <u>how</u> was not addressed in the legislation and has received little attention in the literature.

In an article about the process of providing vocational education to the handicapped, Tindall (1975) suggested that there were various stages

in this process. One of these stages included modifying educational programs and supportive services in order to enable the handicapped person to achieve. He noted that progress had been made in providing accessibility to those students with highly visible handicaps such as physically, visually, or hearing impaired. However, those students with handicaps which are not so readily seen, such as the mentally retarded and learning disabled, were experiencing more difficulty in overcoming barriers to accessibility. Furthermore, services which would open the educational door to the severely handicapped were virtually nonexistent, indicating the barriers had not been adequately defined. Tindall noted that "diagnosis and prescription of solutions must be stepped up." Yet no specific means of accomplishing this were offered.

Several studies have recognized the need for a systematic planning process for providing education to handicapped students (Burello, Kaye, and Nutter, 1978; Phelps and Halloran, 1976; Tindall, 1975; Clarcq and Maruggi, 1978). Since assessment of educational needs represents the first step in many educational planning models (Kaufmann, 1972; Havelock, 1969; Manneback and Stilewell, 1974; Miller, 1976; Holt, 1976; Marrs and Helge, 1978), there is a need for valid and reliable barrier identification techniques at this point in the process. Very few attempts have been made to develop such techniques, and those that have have been limited in their scope and effectiveness.

Gollay and Doucette (1978) offered one method of identifying the barriers to vocational education of handicapped persons. The procedure required the administrator to imagine a "typical" day of a disabled student at school. After visualizing the barriers encountered by the student in performing daily activities, he or she could then confirm these observations by asking the disabled students what barriers they perceived. In addition, the authors suggested a survey of the architectural barriers found in buildings by using a checklist or form available from organizations concerned with architectural accessibility.

There are several problems with this technique which may limit its application. The procedure is highly subjective and relies on the perceptions of an educator to be accurate as well as comprehensive. Although

the procedure does include consumers as a means of verification, it does not involve a number of other people whose perceptions may also be important to include (e.g., parents, support personnel, etc.). This may affect its ability to be used as a valid means to identify additional barriers from various viewpoints. The article does caution that one technique may not be enough to identify every barrier related to every handicap in every program.

The survey (Schwartz, 1977; Kumar, 1977; Camaren, et al., 1977; Tindall, 1977; Holmes and Omvig, 1975; Greenwood and Morley, 1977; Franken, 1977; Manzitti, et al., 1976; Koble, 1976; Bowser and Roberson, 1977) is one of two other techniques which have been used to identify barriers. The survey and the use of experts represent the primary attempts by vocational educators to approach the issue of barrier identification in a systematic manner (Revis and Revis, 1978; Tindall, 1975; Reeder and Linkowski, 1976; Park, 1975; Dwyer, 1973; Clarcq and Maruggi, 1978; Carl, 1972; Leonard, 1978). These approaches will be discussed in detail in the technique section of this paper. It should be noted, however, that no single technique can claim universal application to identify every barrier in a variety of situations.

In summary, the literature indicates and is symptomatic of problems in providing accessibility to vocational education for handicapped persons. The critical concepts of "handicap" and "barrier" are subject to various and confusing definitions. Though the literature consistently points to the need for identifying barriers, it is often vague on how this is to be done. The few techniques that have been suggested or tried are either flawed or have limited application.

What is needed to begin the process of making vocational education programs accessible to the handicapped are techniques by which local educational officials can identify the barriers to their programs. More specifically, an array of techniques is needed to fit a variety of circumstances. Given the fact that each school system will vary in size and the resources available to it, school administrators need an array of techniques for barrier identification, one of which would be appropriate to their circumstances. Using barrier identification techniques represents

the first step in the process necessary to provide accessibility. Such a technique will enable the administrator to be fully aware of the barriers in his program and facilitate planned action in dealing with them.

IV. TECHNIQUES

Role Playing--A Suggested Preliminary

Prior to initiating a technique, a procedure to heighten awareness and sensitivity to the issue of barriers may be used. Role playing is a recommended procedure which can be used to enhance the results of other techniques proposed. It is particularly useful in situations where familiarity with issues and problems of the handicapped is limited. Role playing was developed formally in the 1930's by Moreno as a psychotherapeutic technique and was espoused as fostering better human relations by Josephine Klein in her 1963 book, Working with Groups.

A. Description

Role playing is a procedure used to increase sensitivity or develop perceptiveness to a particular situation. It requires participants to perform spontaneously, given a hypothetical situation and a brief role description. The role player makes up his own lines as he goes along. The object of a role playing is to gain a better understanding of another person's role in life by playing it. For example, a participant may role play a handicapped person by using a wheelchair, blindfold, ear plugs or by being a mildly retarded student in a regular class (Guskin, 1973).

Role playing is a simple procedure to use. It requires little in the way of facilities and preparation. A room large enough to accommodate the group is sufficient; noise actually seems to stimulate better role playing. Props such as tables and chairs may or may not be necessary to the drama. Cards with names and/or role identification are helpful in role plays involving many participants. No special training is required by the director or the participants involved.

Role play simulations may be conducted with any number of participants. The size of the group is determined by the number of persons needed to act out the skit. Individuals may role play or simulate another person's life situation to gain better insight into the other person's view of the world. For example, an ambulatory individual may use a wheelchair for a day or week to see what problems the physically handicapped experience. Multiple groups may be used to maximize participation and to allow for different outcomes to emerge. The leader should discuss what is happening, integrate it with the real problem, redirect the action along more meaningful lines or arbitrate any disputes which may arise.

All descriptions of role playing include at least a 30-minute debriefing session at the end of the "drama." The leader has an opportunity here to put the simulation in proper perspective by drawing attention to how some of the events came about. Discussion helps to identify and understand the issues in the context of a role-play situation.

Role playing is most appropriate when people need to feel what it's like to be another person, to see the problem from the other's point of view. It works best with interpersonal conflicts which may be resolved by assuming another's role and, consequently, by trying out new ways of behaving toward one another. Role playing is appropriate when the problem is complex and involves attitudinal as well as physical and program variables.

B. Strengths and Weaknesses

Role playing is inexpensive, highly adaptable, and requires little effort and experience to implement. It is an active learning process in which all must participate. Since role plays are based closely on particular problems, there is little difficulty in applying what is learned from them. Personal interest in the drama being enacted is usually very high. Participants are allowed to learn from their own mistakes and those of others without serious consequences; at the same time, they can be made to see their own actions from another point of view. Most participants get from the role-play experience a broadened perspective and a more interdisciplinary approach to the problem.

There are also some disadvantages associated with role playing. The time required can be considerable, depending on how complicated the problem is and whether those developing the scenarios have had much experience in abstracting the bare essentials of a problem by removing irrelevant details. Previously developed role plays applicable to a local situation are rare, and consultants, costly. The logistics and operation of the technique may also be problems, depending on the nature of the scenario which is developed.

Survey

The survey is one procedure that has been used specifically to determine barriers to vocational education to the handicapped. It has been used to identify objectively defined barriers (Schwartz, 1977; Florida State Advisory Council on Vocational and Technical Education, 1977; Kumar, 1977) as well as perceived barriers (Camaren, et al., 1977; Tindall, 1977; Holmes and Omvig, 1975; Hughes, 1978; Greenwood and Morley, 1977; Kumar, 1977, Franken, 1977; Manzitti, et al., 1976; Koble, 1976; Bowser and Robinson, 1977). It is a common technique used in virtually all fields and an approach with which the general public is generally familiar. Surveys and questionnaires may take various forms and the literature abounds with directions on construction and discussions of theoretical issues of questionnaire development.

A. Description

Personal interview is one form of survey technique although time has witnessed the replacement of this form with the self-administered questionnaire. Another form is the telephone survey which has become increasingly more popular as the costs associated with personal interview and mailed questionnaires have soared. Telephone surveys cost about one-third as much as personal interviews and have a higher response rate than mailed questionnaires (Dillman, 1978).

The many survey types may be differentiated in terms of the following dimensions. The purpose of a questionnaire or survey may be descriptive, to gather information about a subject or condition, or analytic, to ascertain

the relationship between beliefs, practices, and attitudes. One may wish to sample the whole general population or some special section of it. Information from the whole population or some random or stratified sample may be needed.

A suggested sample would consist of 130-200 persons identified and contacted. This is to obtain 100 completed questionnaires, a minimum necessary for meaningful analysis of the results. The requirement of a sophisticated sampling design is one factor which may limit the use of surveys by a local school system.

By means of a mailed questionnaire, more and more accurate information may be obtained for a smaller investment of time and money than from almost any other information-gathering technique. If the true opinions and feelings of a particular group of people such as teachers of vocational education are needed, then their individual reports are more desirable than a supervisor's best estimate of them. If the needs of the local handicapped population are to be known, some form of survey may be employed, recognizing that incidence varies geographically. The questionnaire can elicit both kinds of information accurately, provided the proper planning steps are followed in developing it. If the questionnaire planner can reasonably assume that the population he is sampling can read, the results of the survey should be fairly valid and reliable.

To aid in barrier identification, a questionnaire or survey format would be appropriate for collecting descriptive information on the handicapped student population to be served by the vocational program of each education system. This information could be gathered from the directors of special education, vocational education, or vocational rehabilitation. Questionnaires could also be used to measure the attitudes of vocational teachers toward handicapped students, since teachers' attitudes have been identified as a barrier. A mailed-out self-administered questionnaire (anonymous for teachers) would be the most appropriate format for collecting either kind of information. Mailed questionnaires, though imperfect, also represent the best compromise between the complete, ideal information desired and the practical considerations of available resources.

B. Strengths and Weaknesses

There are several strengths to the use of this technique. It is well suited to identify the needs of the general public as well as of specific subgroups. If carefully designed, the survey may be used for a rigorous statistical analysis of data.

There are also disadvantages to surveys in that they are easily biased. The cost in terms of time, money and expertise can be high. Most importantly, there are problems regarding its reliability and validity. Reliability refers to consistency, to the chance of getting the same results from administering the questionnaire again. Validity covers all the problems associated with whether a questionnaire really measures what it is intended to measure. For example, validity may be limited by the initial selection of participants or by the rate of return.

With attitude questions the issues of reliability and validity are even more crucial. Reliability is established by asking several versions of the same question and measuring the degree of agreement among them. The lack of external criteria is the chief problem in assessing the validity of attitude questions. The usual way to establish the validity of an attitude measure is to correlate its scores with those from some other measure of the same attitude or another underlying attitudinal variable or value such as authoritarianism. It is also possible to compare the results of one questionnaire with those of other studies published on the same population.

Expert Opinion

A technique which has been used in vocational education is the use of experts to identify barriers. Employing an expert or panel of experts to perform an assessment is an inexpensive and effective way of verifying and/or elaborating on identification findings. An expert is an individual who has acquired special experience and knowledge of the needs of the handicapped. A school system can identify an expert from many fields relevant to vocational

education. This may include teachers who have had experience and interest with special needs populations, coordinators who have demonstrated effective means of recruiting and including the handicapped in programs, counselors who have successfully served the needs of handicapped students, and especially consumers who have used or have been identified as potential users of the vocational education programs.

Experts may be used individually or collectively and may represent a diversity of skills, training and experience. The President's Committee on Employment of the Handicapped is representative of a group of experts meeting to identify barriers to handicapped. On a more regional basis, site review teams consisting of experts representing vocational rehabilitation, special education, vocational education, advocacy groups and consumers have been used to evaluate accessiblity in a particular school district or institution.

Individuals are also used to identify barriers. The literature abounds with articles by national experts identifying universal barriers as well as barriers to vocational education of the handicapped (Revis and Revis, 1978; Tindall, 1975; Park, 1975; Dwyer, 1973: Clarcq and Maruggi, 1978; Carl, 1972; Leonard, 1978). Individual experts may also be used on a local level, drawing on past experience and training to help administrators collect and evaluate relevant data, design an appropriate assessment process for their particular district, and to evaluate programs in terms of accessibility to the handicapped.

A. Description

Using expert opinion may take various forms. Opinions and reports of research in the professional literature provide the most commonly available and widely used form of expert opinion. An expert may be used informally, that is, as a means of identifying general barriers to accessibility, thereby establishing a starting point for use of other techniques. For example, an expert may be able to offer broad categories of barriers applicable to a certain school district. This information may then be used to develop a Delphi questionnaire, a Nominal Group questionnaire or a survey instrument. Experts may also be used on a more formal basis as a technique facilitator

such as a consultant, a member of a technical assistance group or as part of a site review team. The use of experts in the latter forms (consultant, technical assistant, site review team member) will be discussed at length later in this paper. The more informal use of experts has been described here.

An administrator may find the use of experts, particularly those available locally, advantageous as a starting point in a barrier identification assessment. Expert opinion provides the administrator with a broader view of the problems associated with the handicapped. However, it is recommended that these collective opinions or judgments be viewed as a "means to an end," not an end in themselves.

B. Strengths and Weaknesses

The advantage of using experts for barrier identification is that school systems generally have local experts available. This means that cost may be kept at a minimum. However, one important consideration is that the use of experts may include dealing with "professional biases" or consumers reflecting only special interest groups. It is strongly recommended that several experts be used in order to acquire a wide range of perspectives to the problem.

The Delphi Technique

A technique which has had limited use in identification of barriers is the Delphi technique. Although the Delphi has been used or has been recommended for use in both general education planning and special education planning (Sirois and Iwanicki, 1978; Cypert and Gant, 1971; Mann, 1975; Cone, 1978; Rasp, 1974; Schipper and Kenowitz, 1976), its specific application to barrier identification for the handicapped has been limited (Hughes, 1978; McClellan and Newton, 1977).

Although the Delphi technique is relatively new in the field of education, since its development in the late 1940's by Olaf Helmer and Norman Dalkey of the Rand Corporation, it has seen extensive use in a variety of applications and fields such as medicine, science and business. Delphi can

be an effective planning tool for educators in determining planning priorities and identifying needs and goals.

A. Description

The Delphi technique is a method of amassing individual expert opinion into a collective view while minimizing some of the difficulties inherent in a face-to-face meeting. The technique utilizes carefully designed questionnaires to collect, evaluate and tabulate the opinions, ideas and intuitions of individuals with expertise in a particular area who never physically met. Those who are chosen to participate in the Delphi procedure are interrogated by sequential mailed questionnaires rather than being convened to participate in a group discussion or debate.

The Delphi technique has been shown to be an excellent resource in any situation in which planning calls for polling opinions from like as well as diverse groups. Depending on the objective of the Delphi study, an administrator may expect an aggregated group response to problem identification or specific response to solutions or their alternatives. Other uses of the Delphi have been the forecasting of specific events, an exchange of technical information and its implications, problem exploration and decision-making related to specific planning. For example, the process has been successfully used in Charleston County Schools, Charleston, South Carolina (Cone, 1978) to plan specific proposals concerning school vandalism, student disruptions, as well as changes and improvement in the personnel policy manual. Students, teachers and various community groups were included in the former, while all teachers were polled in the latter. In all cases, the resulting data provided a variety of solutions, representing many groups.

As it has been stated by its chief proponents (Delbecq et al., 1975), this technique can be used to achieve a number of objectives:

1) to identify and rank a number of needs (or barriers),
2) to delineate and develop program alternatives,

3) to aggregate judgments on a subject utilizing professionals in a variety of disciplines,

4) to examine the various opinions which lead to different judgments,

5) to inform the respondent group of the various aspects of a particular problem or subject, and

6) to identify information by which to help the respondent group reach consensus.

B. Strengths and Weaknesses

The Delphi technique is generally accepted to be a fast, relatively inexpensive, easily understood group method which can be applied whenever expert opinion can be elicited. It is designed with features which contribute to its value in a needs assessment and planning process. One of the features of the Delphi technique is that it elicits individual opinions anonymously. With anonymity guaranteed, conforming behavior should be virtually eliminated. At no time is a group member required to defend his or her position before another. This ensures that differing opinions will be welcomed without threat and utilized in working toward a common goal.

The Delphi procedure also contains the safeguard that the group will not be dominated by its more vocal members. It insures equal representation of opinions by virtue of the fact that there is no face-to-face contact. This makes a heterogenous group (members with varying personalities, different opinions, and unlike status) possible and highly productive.

Several requirements of the technique may limit its usefulness. The Delphi does require adequate time and cannot be used when time is severely limited. The complete procedure will take a minimum of approximately 45 days to complete (Delbecq et al., 1975). Since the process requires ongoing analysis and feedback until its completion, it is demanding of staff time. The cost of postage and followup phone calls to participants (if necessary) may also make this technique costly as well as time-consuming.

One final weakness is variable and difficult to calculate. The validity of the results of the Delphi technique are directly affected by the persons involved and their willingness to stay with the project. "Dropout" rates

among the participants will directly affect the validity of the technique if the rates are high.

Nominal Group

The Nominal Group technique is a procedure which has been successfully used in industrial, governmental, health and educational organizations. This technique has been identified as having been used for barrier identification in studies concerning "mainstreaming" exceptional students (Paul, 1974; Paul, Turnbull and Cruickshank, 1977). Although the procedure has not been used extensively in the field of vocational education (Hughes and Lunsford, 1977; Rice, et al., 1978), the applications that have been made show that a number of its characteristics make it potentially useful as a primary barrier identification technique. Most notably, Nominal Group requires the involvement and commitment of key people in the school system and community who are involved in the provision of vocationally related services and directly concerned with access in the determination of barriers. The Nominal Group technique maximizes this type of community involvement. It was derived from studies of problems involving citizen participation in program planning, social psychological studies of decision conferences, and management science studies of aggregated group judgments.

A. Description

The Nominal Group technique is a structured group meeting which follows a prescribed sequence of problem-solving steps. It is designed to be used by a small group of seven to nine members whose goal is to generate a variety of quality ideas about a topic. A large group must be divided into smaller groups consisting of seven to nine members.

Nominal Group technique (NGT) is designed to be used when problem-solving or generating ideas are called for. It is an appropriate group process to: (1) identify various elements of a problem, (2) identify elements of a solution; and (3) establish a priority listing of these elements. It is particularly useful when judgments of many individuals must be decoded and aggregated into a group decision.

The Nominal Group technique is particularly helpful to the administrator when she/he must involve not only their own professional staff in program planning but also others (support personnel, parent groups, consumers, etc.) from different backgrounds, positions and perspectives. In addition, NGT is specifically designed to assure equal participation of all involved in the planning process. It assures effective dialogue among group members so that problem-solving is not dominated by a few assertive individuals.

B. Strengths and Weaknesses

Generally, the Nominal Group technique is effective for decision-making, needs identification or idea sharing. It incorporates some advantages of interacting groups while minimizing some disadvantages. For example, one disadvantage of interacting groups is that certain individuals may dominate, particularly those with high status or leadership positions. All members of the group do not contribute equally. In addition, there is pressure to conform to the dominating individual's ideas, thereby discouraging new and innovative thinking on a topic. In general, interacting groups have a tendency to expend energy competing for time to share ideas, and discussion has a tendency to stray from the main topic. Valuable time is wasted and decisions, if made at all, are sometimes made in haste.

The Nominal Group process with its various structured steps tends to eliminate many of the pitfalls mentioned above. The silent period encourages group members to generate ideas as well as to feel responsible for the group's success. It also allows members to share personal concerns and potentially unpopular ideas while avoiding the sometimes "hidden agenda" of interacting groups.

A "round robin" presentation of ideas without criticism guarantees that all ideas will be heard. During the discussion period which follows, the benefits of the "interacting technique" are realized: information is shared and feedback given. It is an opportunity to discuss and clarify ideas. It is relatively unstructured, guided merely by the amount of time allowed for this discussion phase.

The research of Delbecq and others (Van de Ven, 1974; Van de Ven and Delbecq, 1974; Dunnette, Campbell and Justad, 1963; Bouchard and Hane, 1974)

has established that nominal groups tend to produce more creative and more acceptable solutions to problems, particularly when group members are varied either in status, role views or opinions. Thus, it reduces the amount of conflict and tension sometimes associated with such a mixed group.

Although the structured format of the Nominal Group technique has many advantages, there are several aspects of the process which may limit its used under certain circumstances. The rigid format demands a single-purpose, single-topic meeting since it is difficult to change topics in the middle of a meeting. Since structure is imposed on all participants, the format may make some group members feel uncomfortable or manipulated at first. The technique also lacks a certain amount of precision. That is, votes or rankings may be made without a thorough sorting of ideas into appropriate categories. This may result in the repetition of some ideas.

It is recommended that the Nominal Group technique process be used to identify barriers in one school at a time within a particular school system unless the school system is relatively small. Initially, within the Nominal Group membership there should be representatives of the various agencies and constituencies from throughout the community involved in providing vocational education and related services to handicapped individuals. These persons must be provided with an overview of the problem of access to vocational education, with a statement of expectations concerning their behavior, and with some notion of the direction and time frame within which they must work. The overall product of this Nominal Group process will be a list of individual barriers to access to vocational education by handicapped individuals ranked in priority order.

William E. Souder (1975) designed a variation of the Nominal Group technique. Using Nominal Group with a Q-Sort process, a methodology was introduced for conducting organizational evaluations of research and design projects. Results of field testing this combination method indicated that organizational consensus and coordination are increased after its use.

The results also indicated that this methodology is more directly appropriate for decisions related to selection; that is, problem specification, issues analysis, and policy formulation. Its value becomes apparent in situations where a high degree of agreement or general consensus is necessary.

Consultant Technique

Using experts to help identify barriers is a technique which has been previously discussed. The formal use of experts, or consultants, warrants special attention.

A. Description

Broadly defined, a consultant is a professional hired by an organization to provide expert diagnosis, analysis or advice on a particular problem or topic. Consultation is the process of working toward achieving specified organizational results. Educational management does not classify consultation models; however, a few models typical of those currently being used will be discussed.

The most prevalent model used is a "purchase model" in which the administrator purchases expert information or services (Schein, 1969). This model relies on the administrator's ability to correctly diagnose his/her needs and communicate these needs effectively to the consultant. The success of the model also relies on the capability of the consultant to provide the correct information to the administrator and the administrator's ability to accept the responsibility of implementing the potential changes recommended by the consultant.

Another commonly used model is the "diagnostician-patient" model. The consultant is asked to come into an organization and define what is wrong with a particular program or set of services and recommend a suitable therapy. This type of model assumes that the consultant will teach the organization a method of diagnosing and remedying a situation and that the problem will be solved permanently. It is also assumed that future similar problems will be able to be solved in much the same manner.

"Process consultation" was developed by Edgar Schein (1969) to aid organizational development and is potentially applicable to educational consultants. Process consultation is a set of activities begun by the consultant to help the client perceive, understand, and act upon process events which occur within his organization's environment. The consultant's role is defined as helping the organization itself see the problem, share in a diagnosis, and be actively involved in defining solutions. The consultant is required to provide varied alternatives for the organization to consider; however, choosing the alternative is left to the organization itself. This method is based upon behavioral psychology in that the consultant's focus is primarily on interpersonal and group events which lead to change (as well as organizational development through the change process).

When is it appropriate to use consultants? Basically, "outside experts" should be called in when the problem cannot be adequately dealt with using available resources. Some specific circumstances which commonly merit consultation are (1) more information or training in defining and analyzing the problem is needed, (2) no personnel are available to work on the problem, and (3) conflicting views exist within the organization and a disinterested evaluation of the problem is desired (Committee, American Association of School Administrators, 1964).

B. Strengths and Weaknesses

The consultant model has a number of strengths, the foremost being the objectivity of an individual unaffiliated with an organization. A consultant may diagnose needs or present solutions based on information gathered without the pressure of gain or loss by the results of the findings. Since a consultant may enjoy policy freedom, she/he may be better able to manage a power structure than someone who is internally involved.

Consultation offers other advantages. A consultant may offer a unique perspective due to special knowledge and skills. This enables the consultant to see problems with a clarity that those involved with an organization may overlook, avoid or perceive with some degree of anxiety. The consultant process, in contrast with other techniques, may be completed in a shorter time

span because the consultant's primary responsibility is to accomplish specific tasks within a designated time according to contract. A staff member trying to accomplish the same task may not be available due to prior commitments or may be limited by job definition.

There are several limitations to the use of a consultant depending on both attitudes and situations prevalent in some school districts. For example, if the consultant is viewed as fulfilling a "fact finding" function or is hired on the assumption that all that is needed is more information, the results are apt to be disappointing. Facts may not clarify a problem nor provide solutions. The hiring of a consultant sometimes is interpreted as a "handing over" of policy or decision-making responsibilities. Such policy decisions must be made by those who initiate and defend these decisions--people within the organization. The function of a consultant is to order facts, offer alternatives and suggest consequences--not to accept responsibility for them. Some limitations of this technique come with the choice of a particular consultant; the importance of the choice of consultant cannot be overemphasized since a poor choice can hurt the entire school system.

Technical Assistance

There are two special forms of consulting, technical assistance programs and site review teams. Both may offer the services characteristic of the consulting process; however, their composition is markedly different.

Technical assistance systems in special education were the main topic of a national conference in 1974 (Reynolds, 1974). Many papers were presented representing various levels of services from pre-school programs to preparation of special education leaders. Technical assistance for special education students in a vocational education may become available since many such assistance programs exist only to serve changing needs of clientele. It is in this context that administrators may use or establish a need for technical assistance in a vocational education/special education relationship, particularly as it relates to accessibility needs of their programs.

A. Description

Technical assistance programs have been variously referred to as Outreach Programs, Leadership Training Institutes, Coordinating Offices and Regional Resource Centers. Although the name may vary in different parts of the country, the mission of providing systematic organizational support remains the same. The idea of "technical assistance" has been used in other fields for many years. Agriculture, engineering, business and industry have invested much time and money into these systems to cope with change within their fields. It is a more recent development in the field of education with the Office of Education funding educational support systems to provide services to teachers and other school personnel across the country.

Gallagher (1974) defines technical assistance as "help from an outside agency designed to improve the competence of educational service delivery personnel by increasing their management, organizational or program skills, and/or their knowledge related to their jobs as teachers or administrators." Technical assistance systems generally provide two major services to school systems: they act (1) as a broker for consultants and (2) as a change agent for new organizational designs. In either capacity, technical assistance is most properly viewed as a communications network between at least two organizations (Stedman, 1974).

The service that a Technical Assistance system delivers to its clients may occur in three areas (1) organization development and function, (2) internal dynamics, or (3) program and staff development. Technical helps clients with program planning, need assessment, staff development, public education, problem identification and selection of alternative solutions. Since a TA system serves as a brokerage for consulting services or in a consulting capacity itself, it can be assumed that TA can be used in any situation in which the use of a consultant is warranted. These circumstances are clearly defined in the "consultant process" section of this paper.

B. Strengths and Weaknesses

The advantages and limitations of a TA system are related to the type of TA organization delivering the assistance and the source of its funding. For example, if a TA program is operated out of grants and contracts provided by funding agencies, the agency and the TA programs sometimes vie for the client's attention and affections. If a state or federal agency is deliverying the TA, although the service may be free, the mix of a "helping relationship" and a "monitoring role" may not be compatible. Private or "for profit" TA systems may be objective and fast but may not offer the range of staff talents necessary and can be more costly. Systematic organization support is valuable and technical assistance can help. However, few technical assistance networks are available now, especially related to vocational education and the handicapped.

Site Review Team

A. Description

A site review team consists of professionals with particular interests and expertise in the area of special needs populations working together as consultants. The team functions like an individual consultant, that is, in a problem-solving or trouble-shooting capacity. Its goal is to aid an organization (for example, a local education agency, a regional vocational program or a postsecondary institution) in identifying both problems and their solutions, as well as offering strategies for change.

Preparation for using this technique begins with a meeting between the administrator and the site review team chairperson. Topics which need to be discussed include: scope of the project, reports and other feedback procedures (number, type, to whom), fees and other charges (such as lodging and transportation for participants), logistics of the site visit (school schedules, personnel, appointments), and the collection and preparation of background information. Once these pertinent details have been discussed, it is the administrator's responsibility to draft the important details of the review, making arrangements for having relevant personnel available to the team at the time of the visit, and complete necessary preliminary data.

There are many methods of collecting information; however, the most common techniques employed by site review teams are questionnaires, checklists and personal interview. The specific method should be discussed between the team and administrator prior to the actual visit. Specific goals and guidelines should be established so that both parties are clear as to what information is being requested and how this information is going to be obtained. Deadlines for reports, number, form (written or oral), and to whom these reports will be given should be clearly defined so that expectations and responsibilities of both parties will be clear.

On-site visits may vary in content and form, depending on the agreement between the administrator and chairperson of the project. Typically, the visits include: tours of vocational education facilities; interviews with students, teachers, counselors, and other support personnel involved in vocational education programs, meetings with school superintendent, advisory council members, school board members and/or other involved community representatives. Most on-site visits end with a debriefing session with school administrators to discuss preliminary findings, followup and coordination of final reports.

B. Strengths and Weaknesses

The strength of this technique is that it enables the administrator to benefit from various perspectives of the problem since various team members will provide different views of the problem of accessibility. It is also a relatively inexpensive and quick method of assessing a program. However, it is important to note that this technique is time-consuming, requiring an administrator to prepare for the visit, meetings, and followup. The technique increases the involvement of school and community persons in addressing an issue. A wide variety of individuals, from vocational teachers to school board members, can be included in the site visit.

The following techniques will be discussed as a group, entitled "community models." The Community Forum Technique (Siegel, 1975), the Key Informant Approach (Havelock, 1969), Community Impressions Technique (Siegel, 1975), Epidemiology (Franken, 1977), and Social Indicators (Rosen, 1974) are commonly used in identifying community needs in community mental health planning (Miller, 1976). They are impressionistic approaches using citizens reports to assess needs in relation to services provided. It may be well to mention that although these approaches will be considered separately, they are often used in combination. In addition, another technique, Rates Under Treatment, will be briefly presented although its application to an educational system may be limited.

Community Forum Technique

A. Description

People living within a school community are in contact with the school system either directly through use or indirectly through observation. This contact makes community members valuable sources of opinions regarding the needs of the school district. The behaviors and attitudes of the community provide clues to the accessibility of the educational services to the community as a whole. One method of tapping the community perspectives for identification of needs is through a technique called "Community Forum."

The community forum technique has been used in many fields, particularly in the area of mental health (Siegel et al., 1975). It is an open meeting for all members of a designated community. It gives all members of a community the opportunity to share views or feelings about a particular issue. The forum format resembles a "hearing" but is more open and flexible. Any person attending may express his or her views on the subject. The meeting usually lasts three to four hours with some of the meeting time used to disseminate information on new programs, introduction of community members, etc. However, the major thrust of the forum is to elicit as many views from as many people as possible on a single issue. Although it may be said that decision-making may be based on the views expressed at the forum, it is rare that the views are used as the sole criterion for a decision.

The administrators will find that the most appropriate use of the forum technique is to uncover feelings and impressions from the community first-hand.

It is also useful in that it provides publicity for the school system's efforts to listen to the people it serves. It also serves to inform the people as to the school district's intent of identifying needs and its desire to take appropriate action. It cannot be used solely for decision-making but must be viewed as one tool (or step) in the decision-making process since it will not provide in-depth analysis (e.g., causes) of certain needs.

B. Strengths and Weaknesses

There are a number of advantages and disadvantages to this method which may limit its usefulness as a tool for a school district. It is an inexpensive, relatively quick method of needs assessment. Planning and publicity may only take a few weeks and the cost (including staff, publicity, transportation, and recording of results) is minimal. This method allows many views on an issue to be heard, thus giving individuals who have not been served an opportunity to express their concerns. The forum seeks to elicit the opinions of certain groups within the community that have not been heard from previously, thereby encouraging thoughts about issues that may not otherwise have been available.

One of the major disadvantages of the forum is that it is usually not possible for every person attending to have an opportunity to speak. It is also common that some of those who do have a chance to express their views will not be able to speak as long as they would like. This makes it highly probable that certain pertinent information which may be quite relevant to the topic may never be presented. Although many valuable issues may be identified, the discussion usually does not go beyond the identification stage. Thus, cause or possible solutions are rarely obtained. Another disadvantage is that not all members of the community can or will attend the meeting. This allows for one-sided views, and the resulting issues presented may not adequately represent the views of certain parts of the population.

The Key Informant Approach

The Key Informant Approach is a simple survey method that can provide a broad view of community needs and present services. Selected community

leaders and/or agency representatives can use it to assess existing or needed services within a community. This technique is popular among community mental health planners, particularly when better relations and more support is sought among influential members of a community. It can be used within the educational community with the same results in developing support for program change or new program development.

A. Description

Individual personal interviews of "key people" in the community are the bases of this method. The criteria for selecting key people is the individual's knowledge of the community in terms of its needs and services. Key people representing special populations either as providers or consumers should be included. Administrators, educators, students, and workers in the areas relevant to vocational education, special education, health care, support services, etc., should be considered for the present study.

The personal interview is most commonly used with key informant, since it facilitates a free exchange of ideas. The interviewer should begin with a previously composed list of needs by attempting to elicit comments or perhaps even rank order these needs and services. Depending on the purpose of the interview, various other questions are appropriate. Open-ended questions which encourage new ideas or undiscovered needs might be used. At the other extreme, when needs have been previously established, the interviewer just asks the frequency of occurrence of a given need. Planned uses of the results should provide guidelines as to the form of the questionnaire or interview.

The key informant technique may also be used in mailed questionnaires which are discussed elsewhere. The telephone interview is another method of collecting information from key informants. A combination of a telephone interview, a mailed questionnaire and a personal interview could also be considered. Time and resource should dictate the choice. Interviewers should be provided instruction about proper use of forms, coding responses, and asking "leading questions."

The results should be summarized and put into a table. Interpretations may be discussed by the key informants after the interviews have taken place. Such a meeting may well establish priorities and other recommendations about the program. A final report summarizing the method, purpose, findings and recommendations of the study should be prepared and mailed to all informants so that interagency cooperation and communication can be fostered.

B. Strengths and Weaknesses

This approach offers the advantage of being simple and inexpensive to use. It also promotes the support of those individuals viewed as influential in the community. This is particularly useful when a new program or modification of an old one is being considered. Its major limitation is that the results will most certainly be biased toward the individual or organizational perspectives of those being surveyed. It is also possible that those identified as "key informants" may be unaware of unmet needs which exist in their community.

Community Impressions Technique

The Community Impressions Technique has been used to identify mental health needs in the field of community health planning. This technique does not claim to provide all information needed for a comprehensive needs assessment; however, it does identify and involve those groups with the greatest service needs. Although the review of the literature did not indicate that the technique has been used in the area of education, the following description outlines how it might be.

A. Description

The Community Impression technique combines and collects existing data relevant to educational needs in a community, with impressions about such needs from key individuals living or working within the community. (Siegel et al., 1975). It further seeks to verify the information by conducting interviews with groups or individuals within the community having the greatest unmet educational needs.

The Community Impressions approach would be useful to the administrator who is interested in a quick and inexpensive assessment of unmet educational needs within a school district. It will take into consideration the content of existing data (should the school district have such information available) but will also consider the ideas, thoughts, and attitudes of various community members. An administrator who seeks to involve those identified as having the greatest needs in the process to develop programs to alleviate these needs will find this method particularly valuable.

B. Strengths and Weaknesses

The Community Impressions approach does not require much money or time. It also allows for the discovery of "variables" which may never have been considered since several data sources are used. The approach does not guarantee that all needs will be identified nor that individuals with the most pressing needs will be involved. Measures of reliability and validity that can be applied to other needs assessment techniques cannot be applied to this approach.

Application of Epidemiology to Educational Needs Assessment

A. Description

Epidemiology focuses on the distribution of disease, defect, or disability in a community's population. Using the latter as dependent variables, it attempts to study the various personal and environmental factors that cause these conditions. Its primary use has been in planning preventive services. Epidemiological approaches in the field of education as applied to planning and needs assessment are evident in the "child find" activities currently used in many states in response to P.L. 94-142. Prevalence surveys, such as employed by Franken (1977), also represent a focus on prevalence of handicapping conditions within school districts to determine future educational strategies.

The various uses of this technique have been cited in several publications. The following three seem to be most applicable to education. This technique may provide the administrator with information in the following areas:

1) Time period comparison--allowing planners to study problem areas which demand immediate attention as distinguished from those of decreasing priority. It can also point to problem areas which which could worsen, thereby allowing the administrator "advance warning." In order to obtain this information, baseline data regarding the school system should be available from the past. These data will enable the school system to estimate the scope and direction of problem areas. It may also be possible to collect current data, comparing and contrasting them to data available on a regional or national level.

2) Points of intervention may be established by using data indicating size, location, and distribution of the population exhibiting these conditions.

3) From records indicating age at which individuals are diagnosed as having handicapping conditions, high priority populations can be targeted, allowing educators to plan for present and future services to this population.

B. Strengths and Weaknesses

The strengths of using this technique are evident in the types of information it provides the administrator. As previously stated, the information collected allows interpretation in a number of different ways, such as establishing points of intervention and future planning for services. Limitations to using an epidemiological approach are primarily associated with methodological difficulties. Siegel et al. (1975) cite such problems as definitions of disability, reliability of instruments used, and distinguishing from situational and chronic problems. He does, however, state that careful selection and analysis of data provide important bits of planning information.

Social Indicators as a Needs Assessment Technique in Education

A. Description

The social indicators approach has been used primarily in the social science areas. It is essentially the collecting of hard statistical data from community agencies, school district records and public documents and

applying these findings to reflect the conditions with the community. Some examples of this approach are the Mental Health Demographic Profile System (Rosen, 1974) and School District Data Tapes (Applied Urbanetics, 1977) which use U.S. census data to compile profiles of mental health catchment areas and local education agency service areas, respectively. Although this method could easily be viewed as a simple, inexpensive way of determining needs, it does not directly identify educational needs/barriers. Inferences as to the nature of these educational needs have to be made from the data collected. This method assumes that the needs of a community (or in this case, a particular special population) can be assessed by analyzing data on those factors which are highly correlated with those needs. This information does not lead to specific planning responses.

An administrator might well hire a social worker or sociologist familiar with this method in order to insure that the proper data were collected. Implementation of this approach would involve the following:

1) Select the indices which are most likely to reflect educational needs. (Example of data provided for selection might include data from public documents, school districts, and other agencies.)

2) Establish a norm against which the school district can be compared, such as national norm or average rate in past years of the school district, or rate in a comparable school district.

3) Establish acceptable rate in your school district by drawing on the perceptions of key people identified to represent each handicapping area.

4) Identify your school district rate by seeking data from public documents (Census data, community norm, etc.).

5) Compare your school district rate with the norm or acceptable rate to determine the implications for (a) education programs, (b) resources, and (c) service system.

B. Strengths and Weaknesses

Limitations of the social indicators approach stem from the possibility of "jumping to conclusions" when relating various social factors to unmet

educational needs. Indicators may provide rough estimates as to location or type of problem but will not always clearly pinpoint causes. This approach may be relatively more applicable to postsecondary institutions. Special caution is advised when interpreting social indicators in reports. It is easy to be convinced that two statistically correlated variables are causally related when in fact the relationship is not causal. Such results should be carefully examined when trying to support needs identified using elusive variables.

Rates-Under-Treatment

A. Description

This technique uses data collected about the individuals already using a service in order to predict future needs for that service (Hagedorn et al., 1976). Gross estimates of needs are based on those presently receiving services. In the case of vocational education of the handicapped, for example, the administrator may collect data from the school system and related agencies regarding the types of handicaps in the system, the program use, and the location of services. The information collected may then be used to anticipate similar needs in the future.

B. Strengths and Weaknesses

The major advantage of this approach is that it uses data which are readily available and generally easy to collect. The major disadvantage is that research has clearly shown that the method can show those being served by the school community but cannot identify those not being served. It can clearly show needs being met, but cannot measure unmet needs. In the case of vocational education to the handicapped, estimating by using rates-under-treatment would certainly be misleading.

Decision Trees

Decision trees consist of a graphical representation of a series of alternative decisions. This approach is particularly useful when the decision-maker must consider an entire series of decisions simultaneously rather than a single alternative in isolation. When the number of decisions to be considered becomes too cumbersome for display in the form of a matrix, decision trees are often a useful alternative approach.

A. Description

Alternative decisions are displayed graphically, beginning at the left-hand side of the page. The point at which a decision is to be made, a decision point, is depicted by a square. At this point, a finite number of alternative courses of action are presented and shown as branches emerging to the right side of the decision point.

In addition to decision points, chance points, designated by a circle, are displayed to signify the anticipation of the occurrence of one of the finite states of nature. These are displayed to the right of the decision points and are sometimes accompanied by an estimated probability of occurrence presented along the branch of the chance point. Sometimes it is desirable to display with each decision alternative or state of nature an anticipated payoff along with the estimated probability of occurrence of each payoff. Payoffs may also be thought of as probable outcomes, depending on the nature of the decision tree and the purpose for which it was intended.

The applicability of decision trees to educational management is limited only by the assumptions of the methodology and the imagination of the administrator. The technique has particular applicability to personnel assignment and other resource allocation decisions (McGrath, 1974). Unfortunately, it has not been applied widely. An adaptation of the technique incorporating networking in a computerized system is Fault Tree Analysis and is discussed in the section that follows.

B. Strengths and Weaknesses

One of the most useful aspects of decision trees is that they allow the presentation and consideration of a number of alternative decisions at the same time. Even more important is the effect on perception that this stimulates. Decisions do not occur in isolation in spite of the fact that it is simpler and less taxing to consider them in this way. An example of a possible use of a Decision Tree would be the case where an administrator would like to study the impact of the enrollment of a handicapped student in a vocational education program. Using the graphic display that a Decision Tree provides, the administrator can begin to identify the

impact of such a decision on various parts of the delivery system, e.g., necessary schedule revisions, equipment, adaptation, etc. Decision Tree methodology forces the decision-maker to view the impact of a decision on others and to see the environment as a whole rather than an entity composed of isolated elements.

The technique also serves as a forecasting device when appropriate time parameters are included in the display. The diagram on the following page shows a simple decision tree constructed around the example of Individually Prescribed Instruction (IPI). A two-year time frame is built to demonstrate the future-oriented conceptual approach that is necessitated by the addition of a phased time dimension.

The most critical limitation of decision trees is that the nature of the methodology requires that the number of alternative decisions be finite and, by necessity, small in number. There is always the risk that important alternatives may be omitted by the decision-maker in the construction of the tree. In that sense, as is true with most decision-making devices, the technique is only as good as the information that is available and applied.

When the number of alternatives is kept small, all computations may be done by hand. For extremely large and complex problems, however, it is necessary to use a computer. For many purposes, qualitative information may be omitted entirely, thereby eliminating the necessity of arriving at estimated costs and probabilities of occurrence.

Fault Tree Analysis

Fault Tree Analysis (FTA) is a technique developed as an operations research tool for increasing the probability of success in any system by analyzing the most likely causes of failure that could occur. It was developed by Bell Telephone Laboratories to evaluate the safety of launch control systems. Boeing Company further developed the analytical and mathematical aspects of FTA in the 1960's to evaluate systems safety engineering on aerospace projects. The use of FTA is now mandated by the U.D. Department of Defense for all aerospace projects safety engineering requirements. Applications of FTA will also be found in the field of highway safety and hospital management.

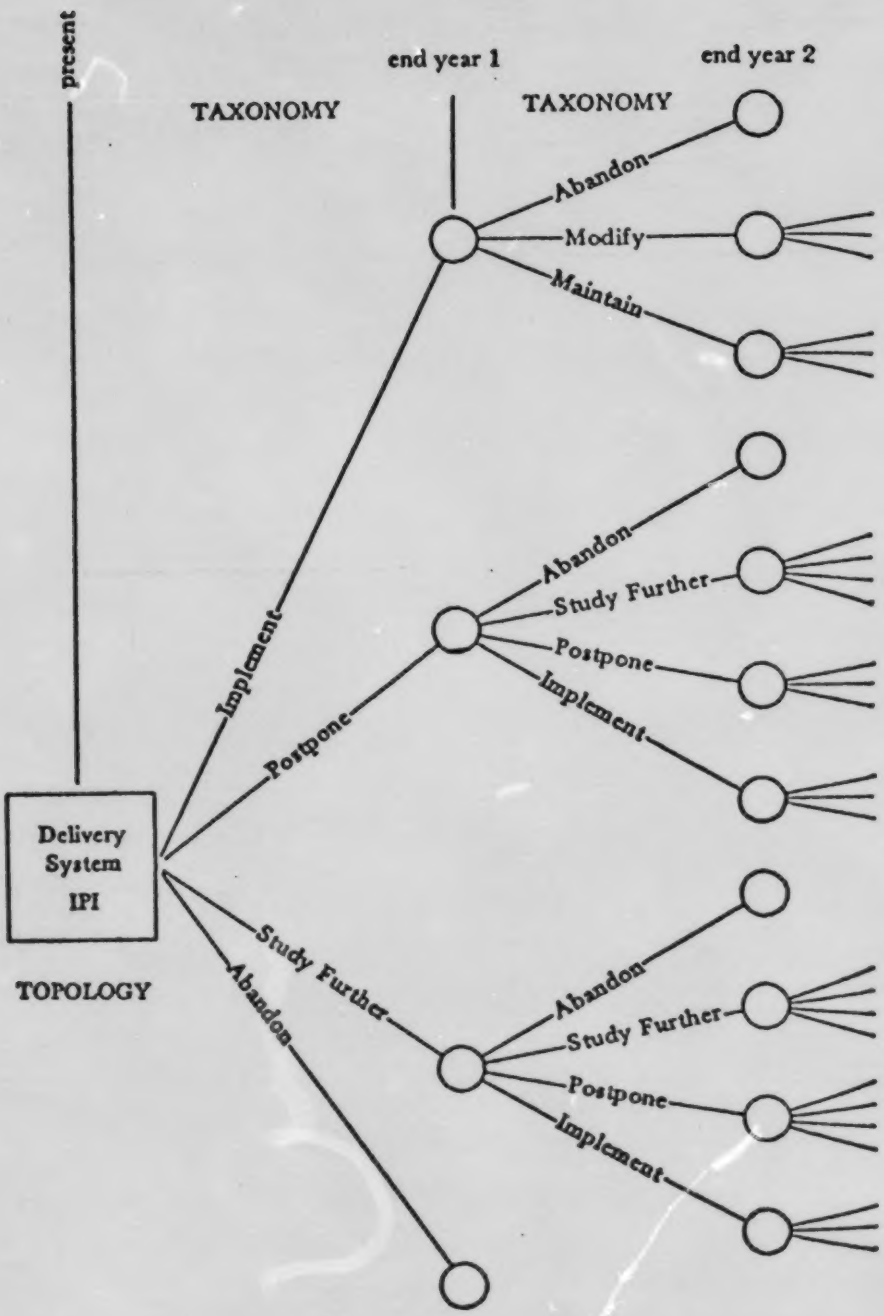

FIGURE 1

Diagram of Typical Decision Tree

(McGrath, 1974)

Application to education was made in the late 1960's by Belle Ruth Witkin and Kent Stephens at the Alameda County PACE Center in California. The technique was thought to be useful as a predictive tool to provide educator's with early warning information to "critical needs" in planning. Research by Witkin and Stephens (1968) and Witkin (1977) confirmed the appropriateness of this technique for educational use. It has been applied to analysis of vocational education systems, adult education, bilingual education, a model experience-based career education project, and a university special education instructional television project.

A. Description

Fault Tree Analysis is based on the idea that to increase the probability of success in any system, one must identify and analyze the most likely modes of failure that could occur. The fault tree (or event logic network, as it is sometimes called) provides an orderly step-by-step description of the various combinations of possible events within a system that can result in the occurrence of a pre-defined "undesired event." This "undesired event" is placed at the top and the various events which may make it happen are "branches" that extend outward and down, hence the analogy to the development of a tree. The branches show how at each stage a given "failure" ("inability of a system to perform its expected function") can occur. When the tree is completed, mathematical formulas based on the probability of the occurrence of each event are applied. The result is a "critical path" which provides the administrator with an indicator of the weakest links in the system, information regarding best allocation of resources, and planning information concerning whether all or part of a system should be redesigned.

Administrators may expect a fault tree to provide them with a logical picture of barriers. For example, a critical undesired event may be "teacher opposes enrollment of handicapped student in his or her class". Examination of this "undesired event" may reveal such factors as lack of teacher preparation for teaching handicapped students, lack of special equipment and materials, and so on, which constitute barriers to enrollment for the student. Each of the "undesired events" can be examined for their content and associated factors to help bring barriers to light. The technique

also has a qualitative and quantitative base for assigning priorities. Its most important contribution to educational planners would be its ability to identify the weaknesses of a plan, thus allowing the administrator to assign appropriate resource allocations to improve the system.

B. Strengths and Weaknesses

Fault Tree Analysis can provide the administrator with valuable planning and decision-making information at various stages of a program. A "tree" may be used as a design tool to evaluate the probable effect of a system which is in operation. It can also be used to evaluate systems already in operation or be used as a means of continuing evaluation available through studying various "branches" of the tree. Probably the most valuable use of FTA is that it provides a logical format in which to analyze opinions and judgments into objective statements of events, thus providing a rationale for decision.

There are disadvantages to the use of Fault Tree Analysis. Those involved in both using and designing the "tree" need to be trained to use appropriate inputs and to provide quantifying information from the "tree." It is also possible to devote much time and effort to "less than critical events" if the major undesired event and its "external forces impinging on the system" are incorrectly identified. FTA may also be too time-consuming and does not follow a classic discrepancy approach.

FTA technology is very new and has yet to be refined to reduce time and cost to educational planners. Research into its uses continues. Its specific application to barrier identification shows promise.

Additional Techniques

Several other techniques were reviewed as to their usability for barrier identification. These included: Brainstorming (and Phillips 66), Force Field Analysis, Synectics, and Simulation. Each of these techniques may have some application to identifying barriers; however, for presentation purposes, they were considered by project staff as being more applicable to other stages of the planning process. The reader is referred to Chapter IV of a companion paper in this series entitled "Vocational Education for Handicapped Students: Group Techniques for Choosing Ways to Remove Barriers"

for a complete description of these techniques.

V. CONCLUSION

Each of the techniques discussed in this paper can help the administrator identify the barriers in their program facing the handicapped. Though they are all helpful toward this end, they differ in many ways. It may be helpful in this section to summarize these techniques in terms of the information each technique provides, its effectiveness, its flexibility, its complexity, and the resources it requires.

1. Information
   - What kind of information does the technique provide?
   - Is the information provided easily interpretable?
2. Effectiveness
   - Are the results dependent on external factors?
   - How valid are the solutions?
3. Flexibility
   - Over what range of educational settings can this technique be applied?
   - Can it be used or adapted for use in various school systems?
4. Complexity
   - How complex is the technique in terms of knowledge and skills required to use it?
   - Is the technique comprehensive enough to include both consumers and providers of vocational education?
5. Resources
   - What is necessary in terms of time, cost and equipment to use the technique?
   - Will resources outside of the school system be required?

A summary of these techniques in terms of these important questions will provide a basis for comparing them. Table 1, "Comparative Summary," is organized vertically by characteristics, and horizontally by techniques. Within each block are brief answers to the questions posed above.

TABLE 1. COMPARATIVE SUMMARY

Characteristics	Survey	Expert Opinion	Nominal Group
Information	Answers to questionnaire provide range of barriers when information is not available from other sources. Ease of interpretation depends on nature and design of questionnaire.	Provides general listing of barriers applicable to some school districts. Interpretive results limited but barrier list may provide basis for using more definitive techniques.	Generates large number of ideas from unique individual perspectives. Has built-in process for prioritizing needs.
Effectiveness	Individual reporting of a particular group (teachers, handicapped students) may better represent situation than supervisory estimates. Surveys are easily biased; wording may influence valid results.	Can be applied in a broad range of settings. Barriers identified may or may not be representative of those existing in various systems.	Relies on perceptions of participants; therefore dependent on knowledge and awareness of those involved. Careful selection of participants allows outcomes to reflect priorities of others.
Flexibility	High; provides means of data collecting across broad section of school community.	High; wide applications since "in system" experts are readily available locally as well as expert opinion from the literature.	High; can be used in any school system that wishes direct, in-depth participation in barrier identification.
Complexity	High; construction phase critical; expertise in design needed. Applicability to gathering information from handicapped pop. may be limited due to nature of disability (level of writing, reading, etc.).	Low; "experts" may include professionals, handicapped persons, and/or representatives of advocacy groups.	Low; can be used to encourage equal participation by administrators and consumers.
Resources Funds Personnel Hours	High Construction, administration and analysis may require a lot of time and expertise.	Low Must be viewed as a starting point for a further in-depth probe.	Low Administrative time and preparation lower than most (88 hrs. average) Cost per group low (Administrative salary + supplies = $230).
Equipment	Computer may be necessary if questionnaires are numerous	No special equipment necessary	No special equipment necessary

TABLE 1. COMPARATIVE SUMMARY (Cont.)

Characteristics	Decision Trees	Fault Tree	Delphi
Information	Rank-ordered list of alternative solutions. Barriers may be located along each decision branch.	Broad listing of events (or barriers) which make programs inaccessible. Results can be interpreted both qualitatively and quantitatively.	Rank-ordered list of barriers (and/or solutions to problems). Questionnaires serve to "refine" lists for ease of interpretation.
Effectiveness	Results may be influenced by those constructing the tree (e.g., omission of a solution). Good as information provided.	Results may be influenced substantially by identification of less than critical events. Solutions can be incomplete if critical events are not properly identified.	Dropout rate of those replying to questionnaire may influence results. Format insures equal representation of opinions. Panel selection critical.
Flexibility	Can be used by an individual decision-maker. Large or complex problems (such as identification of various barriers) may require a computer.	Presently limited. Can potentially be adapted if prototype tree could be designed, although cost may be prohibitive.	Can be used in a variety of situations. Particularly useful in large school systems where face-to-face contact may be difficult.
Complexity	Moderately high; consumers may be involved; however it is designed to be used primarily by administrators.	Moderately high; trained FTA consultant necessary to teach procedures in some cases. Can include administrators, teachers and students.	Low; technique lends itself to including both consumers and others involved in the educational system.
Resources Funds Personnel Hours	Moderate Administrative time involved in tree construction high.	Moderate Requires consultant and computer simulation. Varies as to complexity of problem.	Low Administrative time and cost higher than NGT (141-1/4 hrs./ $440 approx.). Calendar time--5 months start to finish. Average time and cost per participant lower than other techniques (1/2 hr. average working time per participant).
Equipment	May require computer time if problem is complex.	Computer (possibly)	No special equipment

TABLE 1. COMPARATIVE SUMMARY (Cont.)

Characteristics	Consultants	Technical Assistance	Site Review Team
Information	Ordered facts, solutions and alternatives. Analysis of results in a readily usable form must be clearly defined in contract as the responsibility of consultant.	Similar to consulting, assesses needs, problem identification and solution. Easily interpretive format must be specified by administrator.	Problem identification, solutions, suggestions as to alternative solutions. Reports should reflect fact-finding and interpretation of collected data.
Effectiveness	Results may be influenced by choice of consultant. Can be biased by consultant in the interest of consultee's preconceived ideas.	Responsibility to funding resources may influence results. Results may be varied and reflect professional bias.	Conflict of interest may arise depending on participants selected. Results may reflect problems within the system; validity studies unavailable.
Flexibility	High; can be used in many situations. Availability of reliable consultants may influence use.	Limited; adaptable to various needs and situations but only within T.A. guidelines. Availability of T.A. limited in many areas.	High; easily used in a variety of situations since systems have qualified team members available.
Complexity	Moderate; can tap information from target groups depending on consultant's approach.	Low; delivery system may include use of target groups.	Low; technique includes use of experts, as well as perceptions of consumers, providers of services, parents and administrative decision-makers.
Resources	Low to high.	Low to high.	Low.
Funds, Personnel, Hours	Vary; dependent on fees for services (if any) and complexity of problem.	Cost directly related to type of T.A. available (ranges from "free" to charge of fees similar to consulting).	Cost varies according to fees of team participants; free services may be available.
Equipment	Computer, other equipment may be required.	Computer, other equipment may be required.	Computer, other equipment may be required.

Characteristics	Community Forum	Community Impressions	Key Informant
Information	May result in validation if needs rather than identification. Does not have built-in process of data analysis.	Combines existing data re: barriers with impressions from key individuals from the community re: needs. Does not have built-in process for data analysis; technique combines several procedures making interpretation difficult.	Listing of barriers representing various groups. Interpretation of results dependent on design of questionnaire or format of interview.
Effectiveness	Equal representation of various interest groups is doubtful. Difficult to distinguish between needs and demands provided by participants. Timing critical.	Cannot guarantee all needs have been identified based on possibly limited perceptions of key participants. Reliability and validity are highly questionable.	Relies on perceptions of "key influentials" which may not accurately reflect the needs and priorities of others. Information obtained may have low reliability and limited use in generalizing needs.
Flexibility	High; can be used to clarify needs and barriers.	Moderate; availability of data re: previously identified barriers may limit usefulness in some situations.	Moderate; can fit various situations. Administrator may find use in legitimizing needs.
Complexity	Low; seeks to involve a variety of participants but less vocal may not be represented.	Moderate; lends itself to uncovering variables which may not have been considered since various sources are used.	Moderate; key informants may include target groups.
Resources Funds Personnel Hours	Moderate Time and dollar investment, although relatively low, may not be justifiable depending on response.	Low/Moderate Reliability and validity of results may not make it cost-effective.	Low Considerable time commitment from "key influentials" may be difficult to obtain.
Equipment	Large, accessible meeting area a necessity.	No special equipment.	No special equipment.

TABLE 1. COMPARATIVE SUMMARY (Cont.)

Characteristics	Epidemiology	Social Indicators
Information	Focuses on disease, defect or disability as dependent variable; listing of problems (present and potential). Information obtained requires intensive, expert interpretation.	Rough indicators of needs based on past descriptive statistics. Interpretation of statistics should be made by trained evaluator.
Effectiveness	Severe methodological problems (e.g., reliability of measuring instructions, use of research interviews, sampling). Results may reflect bias because of difficulty in distinguishing situational problems from chronic problems.	Estimates of need indicated by statistics may not be significantly correlated with persons in need of services. Causal relationships not easily ascertained.
Flexibility	Potentially applicable, particularly where past data have been kept to establish "baseline" comparisons. Questionable, since few applications to education available.	May be used wherever public records and reports are available for statistical comparisons. Use in educational settings presently limited; valid adaptation questionable for barrier identification.
Complexity	High; data analysis complex; expertise in this area required. Focus primarily on consumers.	High; data analysis necessary. Focus is on past consumer use.
Resources	High	High
Funds, Personnel, Hours	Time and cost involved directly related to how much "baseline data" collected from past years available.	Time and expertise related to data collection and interpretation may be high.
Equipment	Computer generally is necessary.	Computer generally is necessary.

Discussion

1. Information

All of the techniques (with the exception of the Community Forum and Community Impressions) give the user a list of barriers. Nominal Group and Delphi techniques have a built-in process of ranking the identified barriers in terms of the seriousness perceived by the group participants. Decision Trees also offer a rank-ordered list; the list, however, contains alternative solutions rather than specific barriers. Consultants, Technical Assistance Systems, Site Review Teams, and Key Informants may also rank barriers but only if this is requested by the administrator or included among the goals by those using the techniques.

Community Forum, Community Impressions and Expert Opinion generally serve the purpose of validating barriers already identified by other means. Survey, Nominal Group and Delphi techniques are particuarly useful when the administrator needs the direct involvement of those within his or her school system. These techniques yield information in the form of opinions or answers from those directly in contact with the problem.

2. Effectiveness

Research concerning the effectiveness of these techniques is varied. There has been very little research about the effectiveness of Community Forum, Community Impressions, and Key Informants when applied to an educational setting. Site review teams have been reported as effective by those who have felt positive about the results. Surveys have enjoyed wide use; however, their effectiveness has received varied reviews from users and critics alike. The studies of Nominal Groups have indicated highly favorable results but the studies have generally been conducted by those who were involved in developing the technique. The Delphi Technique has received mixed reviews, based on how it has been applied. As a forecasting device, the Delphi Technique is flawed; but as a problem-solving device it has been reviewed more favorably.

Fault Tree and Decision Trees have only recently been applied to educational settings. A limited number of reports as to their effectiveness are available, primarily authored by developers of the techniques.

3. Flexibility

Most of the techniques described are appropriate in a wide variety of educational settings. The use of technical assistance may be limited by its availability. Decision Trees and Fault Tree Analysis are most suited for more complex problems where a variety of alternatives must be made available. In considering the use of any of these techniques, serious thought should be given to the type of problem that is being addressed, the amount of information desired, and its form.

4. Complexity

The techniques range from the simple to the complex. Leadership experience required in such group processes as Nominal Group or Delphi is helpful but not necessarily required. The management of consultants, technical assistance groups or a site review team is slightly more demanding but careful initial contacts tend to reduce an administrative "monitoring role." Use of Surveys, Community Forum, Community Impressions and Key Informants may require more direct administrative involvement. Decision Trees and Fault Tree Analysis generally require logical thinking and may or may not require knowledge of computers and/or computer language.

5. Resources

Estimates about the resources necessary to use these techniques are offered with reservations. The administrator is cautioned to scrutinize costs in terms of time, personnel, money and equipment, with strict consideration of his or her particular circumstances.

Nominal Group and Delphi techniques require the least amount of resources in terms of time, money and equipment when compared to the other techniques. Key Informant and Expert Opinion techniques are also generally low in cost and require no special equipment; however, the process may be slowed since a time commitment from key individuals may be difficult to obtain as well as maintain. Community Forum and Community Impressions require less money, equipment, and personnel/administrative hours but the lesser validity and reliability of their results may not make these techniques cost-effective. Decision Trees and Fault Tree Analysis can be used with few

personnel requirements. These techniques require a considerable amount of administrative time if the trees are to be constructed manually. However, if the problem is complex, consultants and computer time may be additional cost burdens.

The resources necessary to use the Survey technique are extensive. Generally, considerable amounts of personnel time are needed to validly construct, administer and analyze the results of the surveys. Additionally, the expertise of a consultant may be necessary to accomplish these tasks. A computer may also be required, depending on the scope and complexity of the questionnaires.

There is considerable variation in the resources needed to use Consultants, Technical Assistance and Site Review Teams. There is a wide range of costs associated with these techniques since services may be obtained "free" or may become quite expensive if a fee is charged based on hourly or weekly rates of the professionals involved. Time, personnel and equipment commitments will also vary depending on the complexity of the problem.

The subject of costs and resources must be viewed by the administrator in terms of the quality of information obtained. Many of the techniques, although described as low in resource requirements, may not give the administrator the results she/he had hoped for. It is wise not to be "penny-wise and dollar-foolish" in allocating necessary resources.

In summary, the characteristics of a variety of techniques have been presented in order to compare and contrast the merits of each. It is only in the context of each school system that a choice that is most appropriate can be made.

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APPENDIX A

Techniques Rejected for Use in Barrier Identification

- Action Research (Collaborative Action Inquiry)
- Critical Incident Technique
- Derivation Conference
- Discrepancy Analysis Technique
- Gaming
- Goal Rating Procedures (Ratings by scales, card sorts, paired weighting procedure, magnitude estimation scaling)
- Group Observation and Process Analysis
- Kepner-Tregoe
- Human Relations Laboratory (NTL Institute; T-group/sensitivity training)
- Opinion Leadership Utilization
- Phi Delta Kappa Evaluation Model
- Product Development Techniques (Including Input-Output, Buffalo Technique)
- Science Attribute Modification Matrix

MAKING VOCATIONAL EDUCATION ACCESSIBLE TO HANDICAPPED STUDENTS: GROUP TECHNIQUES FOR CHOOSING WAYS TO REMOVE BARRIERS

by

Betsy Lowman

Principal Author

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SYSTEM SCIENCES, INC.

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I. INTRODUCTION

It is important to help the handicapped obtain vocational education. Fewer than one in four handicapped persons are fully employed, and vocational skills are the most important determinants of employment for the handicapped (Phelps, 1977; Cooper, 1977). The problem of extending vocational education to the handicapped is complex because (1) many different handicaps must be served, (2) vocational and special education teachers must combine their educational services, and (3) local, state and Federal agencies responsible for education and related services must coordinate resources and responsibilities. Too often students are not served because they slip between the laws which delineate the authority of different bureaucratic agencies.

Congress has addressed the problem of vocational education for handicapped persons in a series of laws passed over the last 16 years. In 1963 the Vocational Education Act advised state education agencies to provide vocational training for handicapped students. The response of state education agencies was minimal, so Congress passed the Vocational Education Amendments in 1968 which required states to reserve ten percent of their Federal vocational education funds to finance programs for the handicapped. Some states began programs given this incentive, but nationally the picture remained bleak.

Even stronger Federal legislation was passed in the Rehabilitation Act of 1973 and in the amendments to that act in 1974. These laws contain three powerful sections: (1) the elimination of architectural barriers affecting vocational education of the handicapped, (2) the requirement that persons receiving more than $2,500 for work from the Government take "affirmative action" to hire the handicapped, and (3) the prohibition against discrimination on the basis of handicap in any program receiving Federal monies. The first and third sections particularly had potential for affecting public schools.

The latest Federal legislation related to the education of handicapped students is Public Law 94-142 which requires that all students by provided a

"free and appropriate education" in the "least restrictive alternative environment" available. For handicapped persons desiring vocational programs this means that such programs must be made accessible to them if they are provided for other students in the system. This law requires greater coordination and cooperation between special education and vocational education at the high school level than has been evident in the past.

Reaction to the most recent Federal legislation by state and local education agencies was "mixed" at best. Though Federal money was provided for implementation, in 1976 $70 million remained unspent. State and local eudcation agencies argued that they could not afford to provide vocational education for the handicapped and that some school systems were "richer" than others (McCaffre and Higgins, 1977); they also criticized the paperwork and accounting involved, although these activities could be incorporated easily in the procedures currently required in special education (McCaffre and Higgins, 1977).

The present state of Federal-state negotiations over vocational education for the handicapped is changing, with the Federal government threatening to enforce the laws which they have passed. There is a great need for interagency cooperation among the several service areas involved--special education, vocational education and vocational rehabilitation on the Federal, state, and local levels. For school systems which do not comply, the Bureau of Education for the Handicapped is authorized to check on employers and schools; those whose programs are found wanting will be subject to a withholding of Federal funds (Phelps, 1977).

In view of legal incentives, the problem of generating alternate strategies for overcoming barriers has several dimensions. First, it may involve further delineation of the barriers, breaking down "attitudes," for example, into the attitudes of teachers, other students, and the handicapped. It may be necessary to rank order the problems by size of difficulty so that the most important ones are considered first. There is also the problem of deciding who to involve in the decision-making. Truly creative, non-traditional approaches to the formulation of policy is the means by which real change occurs (Hudson, 1975). Once solutions have been generated they need to be evaluated in terms of quality and appropriateness.

Considering the complexity of the problem of choosing ways to remove barriers, the use of group decision-making techniques is most appropriate. A group of people can supply more information and work out solutions acceptable to more people than a lone individual. Important consumer groups can be included in the planning, and the cooperation of those groups insured through participation. Besides, the Federal regulations relevant to vocational education of the handicapped specifically require the use of group techniques.

Goals and Objectives

The purpose of this paper is to identify and describe the various ways to generate strategies for overcoming the barriers to vocational education for the handicapped. It is assumed that the many architectural, attitudinal, and other barriers which exist have been adequately identified through appropriate barrier identification techniques. This paper discusses techniques which can contribute creative, novel, and unique solutions to complex problems. It does not consider the costs of these strategies, nor other variables that might be used in selecting among alternative strategies.

This paper is part of a project to develop a manual to help local vocational education administrators implement new laws affecting vocational education for handicapped students. The manual will provide full information on those current group problem-solving procedures that have utility. The description will include sections on how to use the technique, its strengths and weaknesses, and the level of technical expertise required. Also included will be a comparison of all techniques on the basis of a number of relevant variables and a procedure for choosing the technique most appropriate for a local situation. This state of the arts paper will review much of the material necessary for that manual; most particularly it will indicate which techniques are potentially most useful for choosing ways of removing barriers.

II. METHODOLOGY

The initial problem in identifying different methods for generating alternatives for removing barriers to vocational education of the handicapped was to discover what methods had been used with what degree of success. Information was scattered across a variety of fields--special education, vocational education, medicine, planning, psychology, business administration, and public administration. Generally, the search began with a look at a wide range of efforts in all these areas. Gradually, certain techniques which were mentioned repeatedly and reported to be reliable were identified. These were then pursued individually in the literature.

The first step in the literature review was a computerized search of the current year in ERIC (Research in Education and Current Index to Journals in Education) and SSCI (Social Science Citation Index). Some of the keywords used in these searches were "handicapped students," "vocational education" ("career education"), "vocational rehabilitation," "program planning," "group decision-making," "group strategies," "group problem-solving." After sampling the articles produced by various combinations of keywords, the best keyword combinations were entered in searches of 1973-1976 issues of these indexes. A variety of resources was covered in these indexes, including books, journal articles, and reports to/of Government agencies.

Once individual techniques were identified, a second kind of inquiry began. Books or sections of books were available on most techniques. These were supplemented by hand searches of SSCI, Psychology Abstracts, Current Index to Journals in Education, Education Index, and Business Index, depending on the discipline in which the technique had been developed and, therefore, which indexes were most appropriate. The current state of the research on each technique was based on research reported from 1970 to the present. In several instances, key studies published before 1970 were obtained.

In addition to the literature review, experts in various fields were also consulted for advice and suggestions. Local professionals with experience in

managing group decision-making and problem-solving from the fields of education, psychology, planning, public administration, and business management were contacted. National "experts" on group techniques and program planning such as Ronald Havelock and William Souder were also consulted in the process of identifying and evaluating these methods.

The techniques chosen for discussion in this paper were selected from a greater number mentioned in the literature on group decision-making methods. The guidelines used in making the selection were (1) there was adequate information available to make a detailed description of the procedures, (2) the technique was relatively easy to use, and (3) the method was applicable to the problems at hand. If a technique was merely a variant of some other technique (there are at least a dozen simulation "models," for example), then the guidelines were used to choose the best for this paper. A complete list of techniques which were considered but omitted at this point is given in Appendix A.

III. CURRENT RESEARCH

In order to set the stage for discussion of group problem-solving techniques which follows, a presentation of research on the topic is in order. Beginning with the general topic of group planning and decision-making techniques in the whole field of education, the discussion proceeds to the use of these techniques in special education and vocational education. Where these two fields meet, the vocational education of the handicapped is discussed generally and then with respect to group techniques used for planning or problem-solving. After presenting an argument for employing group techniques for identifying ways to deal with barriers, support for the argument and examples of different methods from the related fields of business and psychology are discussed.

Group Planning in Education Generally

The issues of planning, problem-solving and decision-making have only become prominent in the whole general field of education in the last 20 years or so, since the need for long-range planning has become evident. Likewise, at the Federal level of educational funding, little long-range planning had been done until the Budget Act of 1972 required HEW to develop taxing and spending forecasts for five-year intervals (Fromkin, 1973). In both Government and education, the need for planning has been recognized, but the planning techniques available have been found wanting.

Educational administrators and planners are roughly divided into two groups--those who recommend gradual change along with remediation for past failures, the incremental-remedial model and those who wish to establish long-range goals and then work out means of achieving them, the comprehensive-prescriptive model (Schmidtlein, 1974). Recent disillusion with comprehensive-prescriptive planning models is due to their failure (1) to recognize the complex nature of human behavior, (2) to predict what will be needed in the future, and (c) to differentiate needs at different levels within the school system (Deats, 1976). Planning techniques have resulted in some success but not as much as proponents had projected. Often, an innovator has been able to bring about more change and improvement by knowing the local system than by large scale group planning efforts (Arends, 1977; Havelock, 1973).

One recommendation from the general literature on education was for the quality control of mandated programs (Sirois and Iwanick, 1978). These writers advised using the Delphi technique to develop a group concensus defining an "ideal situation" and then measuring the discrepancy between the ideal and actual program to determine what modifications were needed. The model was attractive but has been little tried in practice. The time seemed ripe for developing some technique to meet the planning needs which are more and more evident, mostly in terms of accountability for expenditure of public funds.

Group Planning in Special Education

In the whole field of special education decision-making has been described as "arbitrary, based on little or no data, and devoid of long-range

planning." (Prozer, 1977). One analysis of 20 school districts indicated that school systems which had planned programs for the handicapped were further toward meeting the goals of P.L. 92-142 than were systems without announced plans (Gourley, 1978); the three significant change agents identified in this study were the superintendent, the president of the board of education and the availability of funds. In another study, Holt (1976) suggested that, in planning services for the handicapped, beginning with definitions and goals could eliminate problems, make plans self-evident, and facilitate measurement of success.

In only two other studies were found descriptions of planning in special education. In a field test of a long-range planning process, the findings included: (1) being involved in a planning workshop did not make participants behave differently from non-participants, (2) special educators responded most positively in a group which included university faculty, board members and general educators, and (3) recommendations generated by the workshop included instances of more coordination among state, regional and local education agencies (Siantz, 1976). Paul, Turnbull and Cruickshank (1977) reported the use of the nominal group technique to identify barriers and force field analysis to list forces supporting or reducing these barriers in a program to begin mainstreaming the handicapped in regular classrooms. Faculty and interested members of the community were involved in both procedures. The authors advised clearly stated objectives to make obvious the data needed for evaluation.

A major national study of services to the handicapped (Kakalik, Brewer, Dougharty, Fleisehauer and Ganansky, 1976) had some sweeping criticisms to offer based on large numbers of interviews with parents of handicapped children and public school educators. They concluded that the $5 billion that the Federal and state Governments have spent on the handicapped was not being used effectively, that there was waste, repetition, and still many unserved children. Some of their recommendations were (1) regional direction centers for parents; (2) improved identification procedures; (3) increased prevention; (4) more medical care; (5) assurance of sensory aids; (6) increased special education programs; (7) expanded vocational rehabilitation; and (8) an office for handicapped within HEW.

Vocational Education of the Handicapped

Advocates for the handicapped, those who drafted the pertinent legislation, and public school personnel responsible for developing the programs have offered advice about vocational education for handicapped students. Advocacy groups emerged following World War II and have changed their position from eliciting pity for the handicapped to emphasizing what handicapped persons can do. The lobbying efforts of advocacy groups have been primarily responsible for the legislation providing for full vocational education of the handicapped (Ruffner, 1978).

In response to these groups, legislators and Federal agencies responsible for writing and applying the laws have expanded technical assistance to state and local education agencies to help them develop plans for vocational education of the handicapped. Part of their efforts have involved providing models for state and local units to emulate. At the same time, enforcement capability has been increased by means of site visitation, "reasonable notice" to a state of violations, and an opportunity for a hearing before cutting off funds.

Reacting to Federal mandates, educators themselves offer various strategies for the secondary education of handicapped students. The broadest perspective offered is "career education" which stresses training in daily living skills, good work habits, good personal habits, and positive attitudes toward work rather than training in specific trades. Industry leaders claim that if these skills are developed in school (Hawkins, 1978), on-the-job training would not be difficult. Handicapped students may wish to participate in traditional vocational programs rather than "career education." Many other educators proclaim the need for identifying barriers and for developing strategies to overcome them without offering any real suggestions (Gollay and Doucette, 1978; Forness, 1977).

Educators also recognize the need for stronger preservice and inservice for teachers to accommodate handicapped in vocational education (Hartley, 1978), and the training modules for this activity have been developed (Phelps,

1976). Since in the future vocational education teachers will be assuming major responsibility for handicapped students, it is suggested that secondary special education teachers should serve as resource teachers providing the "career education" elements as well as special curricular materials and methods for the vocational teacher to help with the learning process (Weisenstein, 1977).

Group Planning in Vocational Education for the Handicapped

No examples of using group planning methods to devise strategies for including handicapped students in vocational education have been reported in the literature. Many states have developed model programs of vocational education for handicapped students (Cegelka, 1977). Wisconsin's has been the most often complimented (Phelps, 1977), though those of Michigan, California, Pennsylvania, Kentucky, Florida, and New Jersey and others have also been cited.

The descriptions of these programs available in the literature report the physical arrangements, staff development, and curriculum materials but not the planning procedures used. The reader is left with the strong suspicion that one individual in an authoritative position did all the planning (Somerton-Fair, Sedlak, Turner and Grotsky, 1978). None report including in the planning members of any groups within or outside the school upon whose cooperation successful implementation of the program ultimately depended!

Rationale for the Use of Group Techniques

There are many reasons for considering using a group of people to deal with the barriers to vocational education of handicapped students. The above discussion of experts indicates the number and variety of people involved with the problem, people on whose cooperation rests the ultimate success or failure of any program. Their concensus and support, which result from working together, represent invaluable assets which can turn against an administrator working alone.

There are two, perhaps three other reasons for employing group rather than individual decision-making. More people can provide more and, through their interaction, better information about the problem and its potential solutions. When several solutions are sought at once, a group may be divided to tackle several problems simultaneously. The third advantage is the possibility of including consumers, the students and/or their parents, which satisfies the Federal mandate to use advisory groups in program planning.

Findings in Business and Psychology

Because few problem-solving or decision-making techniques have been developed in the field of education or special education, the strategies and techniques developed in the related fields of business administration and psychology will need to be considered when planning for vocational education of the handicapped. Brief descriptions of the development of group techniques in each of these areas, as well as examples, will be covered next. Then some of the problems associated with "borrowing" techniques from either field will be described before descriptions of several techniques appropriate for educational planning groups are presented in the next section of this paper.

Because individuals (or individuals operating in sequence), have frequently failed to make decisions, the business community has developed many techniques for group planning and decision-making. Research in the field of business has indicated that groups are better than individuals at making relative rather than absolute decisions, are better at complex problems while individuals are better (faster) at simple problems, and are better when there are variety of possible solutions (King, 1976). The techniques which have been developed within the business context included brainstorming (Clark, 1968), role-playing (Maier, 1963), structured games (Bell and Coplans, 1976), complex computer simulations (Brauers, 1976), and synectics (Gordon, 1961).

Although many group problem-solving techniques have been developed in the business context, most of them apply to concrete problems of production costs, product development or advertising; in very few of the business

techniques are attitudes or interpersonal problems addressed to any degree. Descriptions of the techniques contain directions such as "five is the minimum number for a group" and assume the hierarchical structure among group members which exists in the job setting (Shull, Delbecq and Cummings, 1970). Many of the techniques offered by the business community are not appropriate to psychological problems, but business research firmly supports the superiority of group over individual decision-making.

Group techniques developed in the field of psychology represent a natural extension of group psychotherapeutic techniques invented by Sigmund Freud and his followers. Some of the techniques to come out of the field of psychology are community forums, force field analysis, the Delphi technique, and the nominal group process. Psychological group techniques, like group problem-solving techniques in business, are designed to address problems and make decisions but have more built-in safeguards to protect the integrity of individuals in the group.

Psychologists have also done most of the major research on the dynamics of groups, examining such topics as the common characteristics of all groups, their unspoken rules of operation, the ways different personalities react in different group circumstances, and the effects of different leadership styles on the products of groups. Most of the techniques recommended by psychologists (1) prevent domination of the group by one person or leaders, (2) maximize the input for each individual, and (3) ensure, insofar as possible, that group members feel free and comfortable in saying what they think in the group.

Group techniques having their origins in psychology are less "product oriented" than those from business. The aim of the groups that were organized and studied by psychologists is personal fulfillment or growth rather than task or goal achievement. Recent problem-solving techniques coming from psychology often do have a task orientation, though with a real concern for human interaction too. Of course, these kinds of groups are ideal for solving human problems.

The dynamics of group planning and decision-making in education have been studied. Depending on the decision being made, the people within the

educational system who perform the most critical function have tended to have the most power in the group; power has been described as a function of (1) the individual's capacity to cope with uncertainty, (2) the lack of coping ability among others in the group, and (3) the centrality of the subunit in the organization which he represents (Salancik, Pfeffer and Kelly, 1978). Another researcher found that all participants needed a "psychological decision space," an area of influence in their environment; lacking this decision space they made detrimental decisions (Thorstad, 1975). Both of these studies argued for a democratically-organized and -run group meeting, almost an axiom for group functioning according to psychologists.

Can any of the approaches from business or psychology be adpated for use in the educational setting? By far the most often tried technique is systems management, which has also received much criticism from the educational community. For this reason, systems management techniques are discussed first and then some comment on other methods follow.

A systems approach to a problem has usually involved the following steps: (1) involve and orient key groups, (2) analyze the educational system, (3) define goals, (4) select/create educational programs, (5) prepare for program installation, (6) implement the program, (7) evaluate it (Manneback and Stilewell, 1974). Havelock (1969) had previously recommended a similar outline based on research from 1,000 studies on the planning of change. Many similar planning strategies tried in education have failed.

There are several reasons for the failure of systems analysis. In actuality, a decision may be based on the self-interest of the decision-maker. The approach is also better suited for some decisions than for others, for example, for determining goals and objectives (Sharples, 1975). Other objections are that the sequence denies teachers and others opportunities to devise their own innovations and that educational innovations in one setting do not work in other settings (Thomas, 1975). Evaluating four "grand strategies" proposed for education--accountability, alternative learning, planned change and policy sciences--Fincher (1975) predicts that none would work simply because they are imposed from without and because no

concensus about the nature and sequence of education and schooling exists.

The use of computer simulations to help with decision-making and problem-solving, also from the field of business management, has suffered a similar fate when attempted in an educational setting. Until quite recently, computer costs have been prohibitive (Pograw, 1978). Although the computer-aided solutions can be applied more widely, be found more quickly, and their scope and depth improved, two interpersonal problems remained: (1) by using a common computer language, differences of opinion among decision-makers were highlighted and (2) participants came to believe the computer was infallible (Williamson and Wagner, 1976). Most computer simulattions were found to be useful only to handle concrete problems such as costs and time lines.

One suggestion for improving systems analysis in a setting with many "human" variables is to use the nominal group technique at critical points in the procedure. Vroman (1975) suggests three junctures at which to use the nominal group technique: (1) defining goals: what should the organization do now to survive in the future? (2) developing plans: knowing the system, how should the organization be adapted to your job activities? and (3) evaluation: list barriers to effectiveness in the organization. Some combination of techniques to address both the physical and human problems seems most appropriate for planning vocational education for the handicapped.

To summarize, the research which has been done on group problem-solving strategies in education is quite sparse and the need for planning techniques in this area of education is acute, according to researchers who evaluate the programs. Techniques from the related areas of psychology and business must be borrowed and modified to fit the unique needs and problems of education; caution must be exercised in making selections and modifications lest the technique not fit the local situation to which it is being applied.

IV. AVAILABLE TECHNIQUES

Two kinds of information found in the literature on vocational education for the handicapped which are not related to barriers or to costing methods but do affect the size and range of the problems to be addressed by the techniques are described in this section. A group charged with planning to mainstream handicapped into vocational education needs to know how many students with which kinds of disabilites they can anticipate enrolling in order to decide which services to offer where and when. If Bear Creek Elementary has no hard-of-hearing children and does not anticipate any, does it need a special program for hard-of-hearing children?

The first efforts to implement the new laws (P.L. 94-142) involved having school systems count the number of handicapped students they served in each category of disability during 1976, "Operation Childfind." Data from this national survey indicated that about 12 percent of the school-age population is handicapped, broken down as follows: speech impaired 3.5 percent; mentally retarded 2.3 percent; learning disabled 3.0 percent; emotionally disturbed 2.0 percent; orthopedically impaired 0.5 percent; deaf 0.075 percent; hard-of-hearing 0.5 percent; visually handicapped 0.1 percent; other 0.06 percent (Halloran, 1978). Kennedy and Danielson (1978) suggested subtracting the numbers obtained locally in "Childfind" from the projected figure obtained by multiplying the national percentages for each category by the local population figures. These authors observed that the greatest number of unserved students should be found in the most populous states, in California and the Northeast.

The above procedure yields only a rough estimate and some caution should be exercised in taking the figures obtained literally. The totals are not broken down by elementary and secondary schools, and there are indications the number of handicapped children is decreasing in the elementary school population (Halloran, 1978). A 20-year longitudinal study in England, Scotland, and Wales (Pearson and Peckham, 1977) documents the following trends from elementary to secondary levels: the number of emotionally disturbed students sharply increased, the number of educable mentally retarded decreased slightly, physical handicaps remained the same, and multiple problems emerged. (The

retarded were found to have auditory and visual handicaps.) Such trends probably also occur in the United States.

The following techniques have been presented as potentially useful for identifying alternatives to the barriers in the way of handicapped persons receiving vocational education. These methods were selected from a greater number reviewed in the literature. To repeat, the guidelines used were (1) adequate information, (2) ease of use, (3) similarity to the present problem and (4) uniqueness.

In speculating about group methods it is important to include the question of who will be in the group using the technique. Vocational and special education teachers, public school administrators responsible for meeting the legal requirements, parents and handicapped students, and outside educational and architectural consultants are just some of the people who might be considered for membership. If a wide spectrum of opinion is genuinely desired, all these groups offer a varied perspective; for generating a broad base of support for the changes which will be initiated by the decision made, a very diverse group is also appropriate. The only limitations which might reasonably be placed on group membership are (1) lack of familiaryt with the local school system and the needs of its students and (2) lack of ability to use the group technique selected (such as synectics). In reading about each technique, keep in mind the hypothetical group of educational professionals and consumers who might use the method.

The following methods will be included: brainstorming, force field analysis, nominal group technique, simulation and synectics. Each will be described, its preconditions mentioned, and its strengths and weaknesses listed. Three other interesting methods will be mentioned and the reasons given for their ultimate exclusion from the present collection.

Brainstorming

Brainstorming was introduced in 1949 by Alex Osborn, president of an advertising agency, as a method for a group of people to generate ideas in quantity. It was a very popular technique during the 1950's, primarily with advertising firms and other businesses. It became decidedly less popular

in recent years as newer techniques, retaining many of the strengths of brainstorming and few of its weaknesses, were developed. Brainstorming was often incorporated as one step in these newer procedures.

When brainstorming was introduced most decisions represented a concensus arrived at in "committee meetings" or through "group discussions." In fact, these meetings were usually dominated by the person in authority who called the meeting. Few participants were satisfied with their contribution, and few supervisors with the group's decisions which were often inconclusive. The new technique of brainstorming represented a real improvement in group management to those stymied by traditional group methods.

What can the administrator expect from a brainstorming session? He should receive a list of workable ideas five or six times the number of people in the group. Participants in the session should feel that they have made a positive contribution to the solution of the problem. According to proponents of brainstorming, the enhancement of creative potential resulting from participation in the session should be carried over to other aspects of job performance.

A. Description

A brainstorming group consists of 8 to 15 people called together by a leader to generate ideas about a specific topic or problem; 12 people is considered ideal. Though no special leadership skills or training are required, the role of the leader in brainstorming is critical but unobtrusive. The leader must select the members of the group, making sure members are of equal or nearly equal status in the organization. (Having a person with authority over other members in a brainstorming group has been found to restrict its productivity.)

How does the group proceed? A time limit is given for the session (25 minutes maximum), and a secretary or tape recorder, to collect verbatim all the ideas which are generated, arranged. For groups undertaking brainstorming for the first time, a warm-up exercise, practicing the procedure on a very simple problem for five minutes, is highly recommended. To begin the session, the leader restates the problem to be brainstormed, gives the time limit to be

imposed (25 minutes is recommended) and asks for suggestions about how the problem may be solved. The leader's role after that is to keep the ideas coming and to signal when criticism is offered. Group members spontaneously and voluntarily offer their ideas. If they wish to build upon another's idea, they are provided "clickers" for indicating their desire to break into the discussion.

Brainstorming groups are unique in the strict observation of the following rules which are enforced by the leader.

(1) No criticism of anyone's ideas, actual or implied, is permitted.

(2) "Free-wheeling" (spinning wilder and wilder ideas) is welcomed and encouraged by the leader.

(3) The group should seek to generate as many ideas as possible in the time allowed. The leader frequently urges members to "come up with just 10 more ideas."

(4) Combinations of other ideas (if no denigration is intended) and improvement or refinements of other ideas are sought and encouraged.

Brainstorming is unlimited in its applications, according to its proponents; however, 20 years of experimentation with the technique suggest a more restricted range. The method is most useful in generating novel solutions to problems with which group members have some first-hand experience. Brainstorming is equal or superior to other methods of problem-solving with respect to simple problems, but much less effective with complex problems (Bayless, 1967). The capacity of brainstorming groups to stimulate very novel and unique ideas related to familiar topics is most useful in advertising, the area in which it was originally developed. Brainstorming might also be considered when time and cost limitations rule out other more appropriate techniques as possibilities. The weaknesses discussed in the following section should be kept well in mind when brainstorming is used under such circumstances.

B. Strengths and Weaknesses

Brainstorming groups have been described as fun, interesting and stimulating by those involved in them (Clark, 1969). The list of ideas that a

brainstorming group produces has been found to be superior to the nebulous reports issued by the unstructured committees which the technique replaced (Taylor, Berry & Block, 1958). Most often a large number of ideas or solutions have been generated, of which eight or ten would be totally appropriate; if the followup ranking of these ideas by group members was carried out, the administrator would even have a recommendation of the best course of action.

In comparison studies of brainstorming, newer techniques have been found better than brainstorming for group decision-making. Groups using the Nominal Group or the Delphi technique produced more ideas of better quality than brainstorming groups (Dunnette, Campbell and Jaastad, 1963; Bouchard and Hane, 1970). In operation, brainstorming groups have been observed to be convergent, settling on one line of thought rather than stimulating many different ideas (Madsen and Finger, 1978). Opinion leaders or persons in authority have been found to dominate the group process despite the rules prohibiting such influence. In other studies, brainstorming was found to be better than other techniques with simple and familiar problems but worse with more complex, unfamiliar problems; it was the best in one study when totally novel solutions were required.

Some observations about the research done on brainstorming are in order. First of all, results are inconclusive. In many of these studies researchers have failed to run the group in its classical fashion, with follow-up prioritizing and summary by the facilitator. Most studies have been done in college social psychology laboratories rather than in a real organization. Experiment participants lacked familiarity with the problem or with other participants, so perhaps brainstorming in this context failed to liberate participants from the organizational structure found in the business context and failed to generate enough anxiety to prompt great creativity. It would be important to compare brainstorming with other techniques in a real-life setting. Giving the brainstorming group a list of cue words to increase the quality of their ideas has been suggested (Nelson, Petelle and Monroe, 1974).

C. Phillips 66, A Variant of Brainstorming

"Phillips 66", introduced in 1948 by Phillips, resembles brainstorming but differs in that several very small groups meet simultaneously. The "66" refers to two characteristics of the procedure: the large

group is broken down into smaller groups of six members and each smaller group is given six minutes to discuss or solve some problem.

The Phillips 66 technique has several advantages over brainstorming. The smaller size provides participants more opportunity to talk, thereby preventing domination of the discussion by one person. It also focuses the interest of the group on a specific subject. The small groups may consider different problems or the same problem. With the same problem, the groups' outputs may be compared.

The Phillips 66 technique can be used with caution by planners of vocational education for the handicapped. The limitations on time imposed by the procedure require that those who lead or direct the groups be more highly skilled in stimulating them, more sensitive to group "malfunction" than leaders of regular brainstorming groups. If Phillips 66 is thought of as a further refinement of the brainstorming technique and if the administrator is skilled and experience in leading groups, then he may well consider trying this method.

Force Field Analysis

Force field analysis is a technique for focusing group discussion on the forces operating for and against the realization of a particular goal or possible solution of a particular problem. A force is any physical, organizational, emotional, or attitudinal circumstance which needs to be considered in making a decision in a given situation. Force field analysis is based on the "holistic" psychology of Kurt Lewin.

Lewin believed that a complex network of factors or forces affected an individual, especially when an individual was making a decision. Lewin was interested in all such factors including the form of government under which the person lived, the kind of work he did, the family from which he sprang, and the kinds of dreams and ambitions he cherished. His hope was eventually to assign each of these forces a weight or value and from such weighting to predict what people would do in a given situation.

The results of a group meeting using force field analysis should provide an administrator with a more complete description of the forces in his system operating for and against the various solutions to the problem he is considering. Many should be new to him since the group contributing to the force field analysis represents a necessarily broader perspective than provided by one individual. The group should also have derived the long-range effects on the organization and the people in it for each of the alternative solutions. Again, the information generated about attitudes and values may perhaps be the most valuable output of the analysis, information that is difficult to obtain in other ways.

A. Description

Six to eight persons is the recommended size for a force field group; if the group is larger than this it should be divided. All members of the group should be knowledgeable about the problem at hand, though that knowledge may be personal, as a consumer of goods or services, for example. For the leader it is more important that he feel comfortable directing the group's activity than that he have knowledge of the problem. In fact, an information-seeking attitude on the part of the leader might add to the description of those forces that are all too obvious to participants more directly involved in the problem.

The leader begins the meeting by briefly introducing the concept of force field analysis and describing what the group should accomplish through its use. On the basis of the participants' questions, a practice session of very short duration, on the topic of how to stop smoking, for example, could be conducted. After clearly stating the nature of the problem the leader instructs the group to list first all the restraining forces perpetuating the problem. The leader records all the forces mentioned by the group on newsprint taped to the wall. Then the leader directs participants to list all the "driving forces," those operating to change the situation or solve the problem, which he posts to the left of the list of restraints.

Force field analysis is appropriate any time a thorough diagnosis of the "helps" and "blocks" associated with a particular problem is needed. It is

also appropriate when a complete and accurate list is needed because a group of people can generate more ideas than one person. It works best with just one problem. Force field analysis is also a good method for an outside consultant to use to get information about the organization with which he is working (Lippitt and Lippitt, 1978). Force field can be used after goals have been established to identify forces which operate for and against the realization of each goal. It is also used after initiating a program to identify forces which may enhance or impede the progress of implementation.

B. Strengths and Weaknesses

The strengths and weaknesses of force field analysis are to be discussed in turn. One major advantage it has over an unstructured group decision is that participants avoid disagreement over the sources of problems: the problems are "depersonalized" when described as forces operating at large in the organization or culture. Force field utilizes the resources of many people within the organization and is therefore better than just one person listing forces for and against, even if he is an expert or manager. The technique identifies all the forces, even attitudes and beliefs, affecting the realization of some goal.

Force field analysis is quite generalizable; it has been used to identify problems of goals or programs. An administrator can use it several times in the course of developing a program to alleviate a particular problem. It has been found to be applicable to school settings, community relations, business and industry, and Government (Lippitt and Lippitt, 1978). Force field also works well in conjunction with other group techniques (Paul, Turnbull and Cruickshank, 1977).

Several cautions about the use of force field analysis are in order, however. Despite its availability for over 30 years, very little research has been done on it and only the recommendations of those who have tried it are published. The effectiveness of the technique depends on the skill of the leader in (1) developing a climate of trust in which individuals feel free to express negative as well as positive views and (2) waiting for participants to

identify the long-range effects of different courses of action. Additionally, if participants are not knowledgeable about the subject, the results of the analysis may be inadequate.

A number of the descriptions of the technique in the literature mention only the listing of the forces, without any prioritizing involved. Without the ranking of solutions, force field analysis is incomplete, leading to no decision whatsoever. Patton and Giffin (1973) imply the use of some weighting procedure when they suggest "analyzing the problem intensity." Lippitt and Lippitt suggest prioritizing resources that are not being used effectively and identifying blocks that should be eliminated. Such steps complement Lewin's original procedures.

Nominal Group Technique

The nominal group technique was developed by Andre Delbecq and his colleagues over a ten-year period to increase the effectiveness of group idea generation for program planning. It has been successfully used in industrial, Governmental, health and education organizations. Delbecq's technique minimized the limitations of "natural" interacting groups which were poor for generating ideas and setting priorities. The nominal group technique was found to be helpful to the school administration when he must involve professional staff, support personnel, and parent groups in program planning. NGT was specifically designed to assure equal participation of all involved in the planning process so that the dialogue is not dominated by a few assertive individuals.

A. Description

The nominal group technique is a structured group meeting which follows a prescribed sequence of problem-solving steps. It is designed to be a small group of seven to nine members whose goal is to generate a variety of quality ideas about a topic. A large group must be divided into smaller groups. Participants should include both service providers and consumers. In the present context, this would include vocational educators, special education instructors, vocational rehabilitation counselors, program administrators and handicapped persons. It is important to include persons with different perspectives.

Prior to scheduling the nominal group meeting the administrator should meet with group leaders to clarify the objectives for using this process. Specifically, a question and alternative forms of the question should be developed to which participants can respond. Questions should encourage the expression of individual perspectives on the issue. A sample question about barriers might be, "What is the most serious barrier to providing vocational education to the handicapped?" or "What do you feel is the most pressing unmet need in providing vocational education to the handicapped?"

The group leader should prepare an opening statement to begin the meeting which conveys a sense of the importance of the task, clarifies each member's role in the meeting, and identifies the mission of the group. The group leader then asks each participant to share one idea at a time in "round robin" fashion, and each is recorded on a flip chart. Several rounds may be required for all ideas to be shared.

A discussion period follows in which participants are encouraged to comment on the ideas presented. It is acceptable during this phase of the procedure to add new ideas, eliminate others, and combine or cluster similar ideas. When the leader feels all participants understand fully each idea presented, each member is asked to select privately the five or ten most important items. When the rankings are tallied, a broad listing of needs or barriers which the group as a whole considers to be the main issues is obtained.

Nominal group technique is appropriate when problem-solving or idea generating are desired. With it the following goals are accomplished: (1) to identify various elements of a problem; (2) to identify elements of a solution; and (3) to establish a priority listing of these elements. It is particularly useful when judgments of many individuals must be decoded and aggregated into one group decision.

B. Strengths and Weaknesses

The nominal group technique incorporates some advantages of interacting groups while minimizing some disadvantages. For example, one disadvantage of

interacting groups is that natural leaders dominate discussion, thereby discouraging new and innovative thinking on a topic. Interacting groups expend energy competing for "floor time," and discussion has a tendency to stray from the main topic; time is wasted, and decisions are sometimes made in haste, if made at all.

The structured steps of the nominal group process eliminate the problem mentioned above. The initial silent period encourages group members to think up ideas as well as to feel responsible for the group's success. The NGT also allows members to share personal concerns and potentially unpopular ideas while avoiding the sometimes "hidden agenda" of interacting groups. The discussion period following the "round robin" guarantees that meanings are clarified and ideas sharpened, as in interacting groups. The research of Delbecq and others indicates that nominal groups produce more creative and acceptable solutions than interacting groups (Dunnette, Campbell and Justad, 1963), when group members are varied in status, role, views or opinions because it reduces the amount of conflict and tension sometimes found in groups with varied backgrounds.

Although the nominal group technique has many advantages, there are several aspects of the process which may limit its use under certain circumstances. The structured format demands a single-topic meeting since it is difficult to change topics in the middle of discussion. The format may also make some group members feel uncomfortable or manipulated at first. The technique also lacks a certain amount of precision. That is, votes or rankings may be made without a thorough sorting of ideas into appropriate categories which may results in the repetition of some ideas.

C. The Q-Sort Nominal Group

William E. Souder (1977) originally combined the nominal group technique with a Q-sort process to evaluate research. Field testing this combination method indicated that organizational consensus and coordination increased and that this methodology was more appropriate for problem specification than for issues analysis and policy formulation. Its value became apparent where a

high degree of agreement was necessary. The group's results were then statistically analyzed for inter-individual similarities and overall group consensus.

D. The Charrette

Another method of group planning or decision-making which has been derived from the nominal group technique is the "charrette," a French word meaning an "intensive group planning effort in an open forum format to achieve creative solutions" (Holt, 1974). The technique is most often used by architects to elicit community reactions or input in designing public buildings. When a need exists for those directly and indirectly involved in a program to contribute to the planning process by defining what they want their experiment in that program to be like, the charrette provides a suitable mode of addressing that need. The charrette can be used by planners of vocational education for the handicapped where problems of physical space or allocations exist.

The charrette is similar to other techniques such as the community forum and needs to be distinguished from these other methods. The charrette requires that all factions within the community be represented at the meeting, and a structured set of prescribed steps are followed. The charrette also relies more heavily on outside experts for information and group management than other techniques. Though more often used by architects, charrettes are used by social planners and educators to develop new educational facilities as in Brooklyn, Baltimore, and Boston (Holt, 1974). The results of these charrettes are multi-purpose structures which met a wide range of community needs, for year-round, every day recreation, for example.

In its present adaptation, a charrette is an activity that brings community members and experts together for a limited time period to study a specific problem. The conditions optimal for a charrette include (1) a problem which has not been solved, (2) members of the community who will participate, (3) experts at group management techniques and at the technical problems which may be involved, and (4) a commitment to use the plans and recommendations the charrette produces. A school planning charrette involves

the consumers, teachers, parents, and children who will be affected by the programs which result. Often the most valuable outcome of the process is the sense of commitment and cohesiveness that develops in the struggle of planning together (Sanoff and Barbour, 1974).

1. Description

Several activities must occur before the charrette itself is conducted. A committee of interested citizens is often formed and meets several times to define which problems will be addressed by the charrette and to arrange facilities. Advance publicity about the event through the local media and even a house-to-house announcement of the upcoming event is another function of the organizing committee. The group also must secure the services of outside experts to assist with the charrette; likewise transportation and child-care must be arranged in advance. What food, if any, is to be served during the charrette is still another problem handled by the steering committee.

How long should a charrette be? One day would be sufficient if the problem is well-defined and limited in scope, a marketing problem in industry, for example (Riddick, 1971). Four or five days is recommended when the problem is complex and the group involved is homogeneous in terms of goals and background, teachers or social workers perhaps. For a real geographic community charrette, eight to ten days would not be too long. The problem under present consideration, vocational education for the handicapped, would fall somewhere between the second and third types, since it would be important to include students, teachers, parents and community agency representatives (vocational rehabilitation, small businessmen perhaps) in the planning.

The charrette includes a variety of activities, usually arranged in the following manner. The charrette beings with some sensitizing activity for all participants, a role-play or film or personal testimony. This is followed by a period of "open discussion" at which time conflicting views are often aired. The outside human relations expert is important in managing this exchange in order that discussion not reach an impass and that all participants finish with a positive attitude toward the objectives of the charrette.

The second stage of the charrette usually involves specific identification of problems which the group will address. The problems or objectives may or may not be rank ordered before being given to smaller groups of participants to "brainstorm" ways of dealing with the issue. The smaller groups make periodic written reports to the larger assembled group, usually at the beginning of each day if the charrette is run over several days. Each smaller group has an outside "adviser" to act as facilitator of the group and/or a technical adviser if the problem is a technical one.

The final stage of the charrette is focused on a "jury" or panel composed of those who control the community resources (and possibly some outside experts) who react to the proposals of each small group in terms of financial feasibility. After further discussion between the panel and participants, the proposals may be re-worked by each small committee. A follow-up committee may then be appointed to implement the recommendations of the charrette for several months or a year after the session has ended.

How much would a charrette cost? Riddick estimates the price to run from a few hundred to a few thousand collars, depending on (1) how long it would run, (2) whether full time people had to be employed to organize it, and (3) how much could be donated by local groups in terms of man hours, facilities, or supplies. The major expense, representing over half the budget, is the cost of outside professional consultants. However, free consultants can sometimes be obtained from federal or state governments or from universities. The possibility of federal and state financial aid for the whole charrette is also worthy of investigating.

2. Strengths and Weaknesses

Most advantages of the charrette are obvious. Consumers who participate develop positive feelings of involvement in the activity, can offer a variety of ideas, and are disposed to support the program long after the charrette is concluded. The scope of the problem which a charrrette can consider is quite broad and may be quite complex. More is accomplished in a charrette than in some other groups (such as brainstorming) since the problem is broken down and each small group considers some unique problem. The flexible time and cost frame are other attractive aspects of the charrette.

On the other hand, the charrette has a few disadvantages. Its success hinges on the sensitivity and skill of the charrette manager that is hired, and there is no guarantee that a particular human relations expert will be able to meet the needs of a particular group, despite past successes. If the charrette planning committee fails to develop sufficiently clear goals or fails to relate the problems identified in the initial group meeting to those goals, the small group will waste time identifying its issue and produce little. A third caution which should be voiced about charrettes is that little research has been done on the effectiveness of the technique. Architects who have employed the method advocate its use in building design, but virtually no research has been reported on the technique used with human social problems.

Synectics

W. J. J. Gordon, developing a new technique of group problem-solving around 1950, named it synectics, a Greek derivation meaning to draw together diverse elements. He had in mind two aspects of his technique when he gave it this name--participation of persons with diverse backgrounds and the drawing together of different but analogous ideas from the group's "free association" process of problem-solving. Gordon formed a corporation in order to sell his technique to businesses as a method for developing new products; as a result, synectics has been applied in fewer different settings than most group problem-solving techniques.

Gordon believed that the process of invention was not the "divine inspiration" of a genius but a process of speculation that could be made observable by means of tape recordings of the mental "mutterings" of an individual or a group. Gordon, Prince and other of their associates developed some specific procedures to stimulate and support a group in its problem-solving efforts via "group free association" using analogy and metaphor. Though introduced as a tool for the business community, Prince and others have successfully used it in settings such as Government to solve "people" rather than "product" problems.

When considering this approach, a manager may expect some completely novel solutions to old problems or a completely new invention, a roofing

material that will change from white to black from summer to winter in order to reflect or absorb heat, for example. He can expect to use temporarily experts outside the organization to advise the synectics group if necessary. He can further expect some "hardware," a working model which can be tested for its effectiveness, even for a synectics group working on a behavioral problem. Obviously, the technique is not cheap. Several products of synectics are (1) vapor-proof closures for astronauts' suits, (2) organic paint, and (3) a flexible budgeting strategy for the U.S. Department of Defense.

A. Description

Perhaps it would be best to try first to describe the group free association characteristics of synectics groups. Gordon says it is a process of "making the familiar strange" and "making the strange familiar." Participants are urged to use these mechanisms during the session--personal analogy, direct analogy, and symbolic analogy. Personal analogy requires participants to put themselves into the problem situation as a central element (even as an inanimate object); to imagine, for example, what it feels like to be a virus in a living organism. Direct analogy means looking for similar problems or circumstances in other contexts and noting solutions already devised; natural science analogies are particularly fruitful for synectics groups with product problems, and mechanical devices, with people problems (Prince, 1970). Symbolic analogy is an esthetically satisfying though technically inaccurate image which incorporates a compressed description of the functions or elements of the problem. An example would be the Indian rope trick as a symbol to solve the problem of a collapsible lifting device.

All members of the group are asked to implement the "spectrum policy," the habit of looking at the positive aspects in the "spectrum" of characteristics of a particular idea. Because of group members' natural competiveness and a tendency to criticize, the negative facets of the problem attract immediate attention, and criticism springs to the lips of participants. By first citing the positive characteristics of the idea, asking for clarification, and only then pointing out the flaws in the idea, a participant practices the spectrum policy.

Synectics groups should have five to seven members for optimal operation. The groups can meet continuously for several hours or several days. Length depends on how quickly participants begin to feel comfortable with one another and how involved the problem is. The time spent may be considerable. The wealth of information and solutions provided may be voluminous, however.

Though first implemented in industrial product development, synectics methods have been used successfully in Government and in middle management personnel areas. Synectics is best known for the impressive inventions that synectics groups have developed, but it is potentially adaptable and useful in any situation requiring "making the familiar strange" (or vice versa) with the following precaution: success of the group depends on the skill and training of the leader in eliciting and using the analogous materials generated by group members.

B. Strengths and Weaknesses

In terms of the quality and usefulness of the output, synectics represents an improvement over the traditional methods of decision-making most often used in business. It may be that diverse group membership leads to more general, more original solutions. The synectics leader does more directly to free the individual's unconscious than in any other method which should lead to more creative solutions.

Synectics has other advantages. The knowledge of experts is efficiently used and small group testing of the chosen solution is helpful. Synectics has demonstrated flexibility to solve people problems and problems which have both technical and people aspects. Though not as well known as some other techniques, it is now more available through Prince's recent reformulation of Gordon's theory and his specification of procedures.

Synectics has some limitations. Early critics of synectics have found its best applications were developing new products or improving old products. Because it has only been available from the Cambridge synectics group for many years, applications in other areas have been few. Indeed, further

efforts to apply synectics techniques in less product-oriented organizations may eventually indicate that it is not helpful with less specific problems, despite initial successes.

Other problems associated with synectics are related to the personnel of the group itself. Group members need to be able to make generalizations, to recognize similarities and differences, to transfer knowledge or principles from one situation to another. They have to feel self-confident and be sufficiently well-adjusted to function comfortably in the synectics group. Given these requirements, some people do not function well as synectics members. The leader must also be more skilled than in other groups, because he must be able to recognize and develop quality ideas. Obviously, he must have some experience and training, which can add to the expense of implementation.

Simulation

Simulation may be defined as a representation of a real-life situation in terms of its most essential elements and characteristics. In a simulation, participants take on roles which represent real world conflicts or problems and make decisions in response to their assessment of the setting. Participants experience simulated consequences which relate to their decisions, their interpersonal style, and general performance; afterwards they can monitor results and ponder the relation between their decisions and the consequences. Role-playing, games, and computer simulations are various kinds of simulation. Only computer simulations are discussed here.

Computer models have been developed mostly by engineers and mathematicians to simulate highly technical, complex problems. Computer simulations are very powerful because probability estimates and random events may be built into the models and the limits of time and strength of materials tested. Computer simulations are most appropriate for finding very specific "answers" to technical questions and have less capacity for understanding processes, particularly human interaction.

Computer models are presently used in schools to schedule students, to handle payrolls, and to keep track of personnel. With few modifications,

these models could assist with planning (Pograw, 1978). Because of the anticipated costs, computer simulations have been seldom used in educational decision-making.

The classical model of decision-making and planning requires administrators to choose from among a set of alternatives the one which produces optimal benefits relative to costs. Techniques are assumed to be available to help administrators project the possible effects of alternative policies under existing and/or possible future circumstances. Unfortunately, up until now quantitative techniques in educational administration have possessed limited ability to solve these planning problems or have done so only in an artificial manner. At a time when educational planning is becoming more complex and future-oriented, the limitations of older techniques are becoming more apparent. Computer simulations can handle the complexity of planning problems, and the costs of such applications are decreasing. Sophisticated and easy to use languages such as GPSS, SPSS, BASIC and PL1 have recently been developed and facilitate computer application.

A variety of computer simulations are available such as "fault tree" analysis, decision trees, or systems analysis. All these methods have in common the development of a computer model analogous to the real educational situation, a school's accounting procedures, for example. Once the model is developed, various initial figures may be submitted to find out what would happen under different circumstances. One such technique, cross-impact analysis, is now described as an example of a computer simulation.

A. Description

"Cross-impact analysis is a simulation technique by which one attempts to evaluate average likelihoods of occurrence of each event in a set of interrelated events, considering all possible sequences and occurrences or non-occurrences among the events in the set," according to Enzer (1977) who has most recently improved the method. Gordon and Helmer developed cross-impact as part of the game "Future" for Kaiser Aluminum in 1966. The technique is not as complicated as it sounds.

The following procedures constitute a cross-impact analysis. The significant events are identified after several Delphi rounds. A panel of "experts" indicates the likelihood of occurrence of each event. The final likelihood used is the median of a second round (the initial probabilities). Each event is then matched to each other event in a cross-impact matrix. Each entry in the matrix, generated by computer, shows the new likelihood of occurrence of event "b" if event "a" occurs. From the first matrix the computer derives a second matrix, each entry in which shows the likelihood of event "b" if event "a" does not occur. A final computer operation estimates final probabilities by simulating 1000 rounds of joint occurrences of each event.

Several circumstances warrant the use of simulation techniques. When it is necessary to consider several or all variables of the problem simultaneously, simulation is appropriate. If, given certain pre-conditions, you want to know the probability of an event occurring in order to improve decision-making, simulation techniques could be considered. Another possibility would be when a number of problems could be solved using one procedure. Simulations are much more likely to be used when an organization has access to a computer and money to make the initial investment. In contexts other than education, simulations are often used simply because a computer is there and not because the other conditions have been met. This misapplication has not helped clarify when simulation is the most appropriate technique.

B. Strengths and Weaknesses

Computer simulations offer some important advantages over other available methods. With them the school administrator can be advised of all the possible outcomes of various courses of action simultaneously, whereas other techniques such as Delphi only proceed event by event. The simulations model can be as complicated or as simple as is possible or necessary. With a computer, the user may experiment with situations which he could not actually allow to develop in practice, allowing equipment to wear out, for example.

With the simulation technique, several different variables may be simultaneously manipulated and the results obtained almost instantly, once the

model has been "de-bugged." The technique may be applied to a variety of problems other than vocational education of the handicapped. When more options are considered, the quality of the decisions may be improved (Pograw, 1978). Cross-impact has been used to explore the economic, social and political environment of Europe during 1970-1980, alternative futures for American education, urbanization of Europe 1979-1985 and the social, political and environmental future of Canada (Brauers, 1976).

Computer simulations have several drawbacks, the major one being the adequacy of the model which is developed. However complex the system being investigated, the data generated and decisions made on the basis of that model are only as good as the original programmer who designed the algorithm. The model may or may not be valid depending upon how much information goes into development, how well changes over time are anticipated, what limits are built into the program such as the number of variables that may be entered.

The other weaknesses of simulation techniques are varied. The initial costs of development can be quite high. Human error in entering data or in interpreting results may also occur. Because computers are so fast and efficient, users, particularly those who have limited experience with them, sometimes begin to believe the results infallible; since many problems with the program only become apparent after continued use, disillusion shortly follows. A final danger with simulations is that the decision-making process may become an individual effort when a group involvement is really necessary for the program to be widely supported within the organization.

Other Techniques

Many other problem-solving techniques were examined in the process of identifying the best methods currently available for school planning. Some systems were just identified and dropped immediately because they were of limited applicability. Several methods were examined more fully but finally were determined to be unsuitable for a variety of reasons. These are discussed in this section and their rejection explained.

In the collective notebook technique (Souder and Ziegler, 1977) all participants receive a notebook of materials about a major problem in which

they have some investment. All participants independently record daily or weekly in this notebook their various ideas, recollections, solutions, and facts about the problem for a given period of time, such as a month. After this incubation period, each summarizes his best ideas about the problem and his favorite suggestion for further exploration. The notebooks are then given to a coordinator who prepares a detailed summary of all the notebooks. The summary is shared among participants in preparation for a group meeting at which some final decisions are made about the problem using brainstorming, synectics, or some other technique.

Though introduced by Haefele in 1962, the CNB just has not been highly popular, primarily because it requires so much careful reading and writing by the coordinator in preparing the materials and summaries. Haefele also has recommended "priming," the sending of additional reading materials to participants during the "incubation" period, and the use of good art layouts and a crisp writing style for all materials. Dependence on the coordinator for most of the input and organization has proven the major limitation of the technique.

The Kepner-Tregoe method (Kepner and Tregoe, 1965) is a six-month course for business managers developed "to teach them to be good detectives," to isolate the important characteristics of a problem situation and to define the problem precisely. It is based on the authors' observation that managers often make poor and costly decisions because they know less and less about the activities of their subordinates and base their decisions on what they assume to be the cause of the problem. In the Kepner-Tregoe system the problem is defined as deviation from a previously established standard of performance. Gathering the details of what, when and where the deviation occurred helps establish what changes in operation may be associated with the deviation. Additional procedures developed by Kepner and Tregoe increase managers' ability to prioritize needs, establish objectives, specify alternatives and compare alternatives with objectives.

The Kepner-Tregoe method is unsuitable for use with needs assessment and program planning in education for several reasons. Mainly, it is a "bad

fit"--the authors have a good, general purpose strategy for solving many technical problems which occur most often in industry, while planning vocational education for the handicapped is a large, many-faceted problem for which a shorter and simpler technique is needed. The method is costly and requires at least a year to implement including followup, feedback and evaluation. Also, it is available only through its original developers.

Gaming, a kind of simulation, had a long and rich history, being modeled after chess and monopoly and descended from the war games of ancient times (Darden, 1969). Games involve groups of players placed in prescribed settings with constraining rules and procedures. Play behavior might be competitive or cooperative, involve conflict or collusion, but it was usually limited or partially prescribed. In less familiar games, the initial situation was usually identified and some direction given about how the situation was usually identified and some direction given about how the simulation is expected to work. Games theory was invented by John von Neumann, a Hungarian mathematician, during the 1920's. He intended his writing for economists and social scientists, but when his book Theory of Games and Economic Behavior appeared in 1944, military strategists adopted it for defense planning.

Given a problem, decision dilemma, or confrontation situation, game theory entails the following steps. First, you list as many optional courses of action as possible. Next, you specify which you prefer in reverse order, beginning with what you desire least. The other party's alternatives are listed and the two lists entered on the two axes of a matrix. You then rank the outcomes, the results of the two parties taking these alternate actions, in order to arrive at a decision. The course of action associated with the highest sum of ranks is the one chosen.

Games as an aid in making decisions and developing problem-solving abilities is quite in vogue, particularly in business and industry. Perhaps the most famous and elaborate business game is the Harvard MBA small business simulation developed as a teaching tool. Groups of students form companies which compete to develop and implement an economic strategy. The game takes several weeks, and events are generated and feedback is given through a computer simulation of the economic environment.

Games often have had unexpected consequences which became apparent only after several "run-throughs" of the game. The MBA game, for example, was found to stimulate extreme competition and to foster conservative short-term profit behavior. A game developed by Zukerman (Guskin, 1973) which was intended to generate sympathy for handicapped children among teachers actually created animosity toward mainstreaming them!

Game theory was not given further consideration in this study because the assumptions upon which the procedure rests do not apply to planning mainstreaming the handicapped into vocational education. There is not really an adversary relationship involved in this problem. Game theory may be appropriate to overcoming a specific adversary relationship in a local situation and, therefore, a description of it could be included in a resource materials section of the manual.

V. CONCLUSIONS

In summary, what can be said about this group of decision-making techniques? How are they alike and how different? When should one method be chosen over another? All the techniques discussed above vary in terms of five characteristics which embody most the relevant questions which may be asked about a technique. These five characteristics--kind of information, effectiveness, flexibility, complexity and resources required--are now defined.

Kind of Information. What kinds of output, what products,do you obtain from using this method? With what is the administrator left, once the group has finished?

Effectiveness. How effective is the technique? How dependent are the results of the technique on external factors? How valid are the solutions generated? When thinking of this characteristic, consider the strengths and weaknesses and what has been published about the technique.

Table 1. COMPARISONS OF TECHNIQUES BY CHARACTERISTICS COMMON TO ALL GROUP METHODS.

Characteristics	Group Techniques: Brainstorming	Force Field	Nominal Group	Synectics	Simulation
Kind of Information	Rank-ordered list of novel ideas.	Full description of all forces operating in situation, including attitudes.	Rank-ordered list of alternatives which represents group consensus.	One highly novel & integrated solution, testable working model.	Working computer model system.
Effectiveness	Better than unstructured group; research says not as good as other techniques.	Achieves goals but little research done on topic.	Much research finds it effective; too structured for some;	Very productive but little research.	Depends on "goodness-of-fit" of the model to real setting.
Flexibility	High; any number, any setting.	High; any number, any setting.	High; any number, any setting.	Best with concrete problems.	Applies to many problems and different settings.
Complexity	Low; must only be familiar with the problem.	Low; must only be familiar with the problem.	Moderate; requires good initial question.	Moderate to high; participants must be able to use mechanisms.	Moderate; group must understand what computer does.
Resources Person Hours	2-3 hrs./person.	3-4 hrs./person.	3-4 hrs./person.	20+ hrs./person	20+ hrs./person (not counting programming).
Funds	Minimal.	Minimal.	Minimal.	Moderate to high.	Moderate to high.
Equipment	Room and chairs; chart.	Room and chairs; chart.	Room and chairs; chart.	Outside experts; univ. training program for leaders.	Computer and programmer.

Flexibility. Over what range of educational settings can this technique be applied? Can the method be used in small and large systems?

Complexity. How complex is the technique? What knowledge and skills are required to administer it? Can it be used by both consumers and administrators? How sophisticated must participants be in order to function effectively in the group?

Resources. What resources are required to implement the technique in terms of time (person hours), cost, and equipment? Will outside consultants be necessary?

To condense the information on group methods for generating alternative to barriers in terms of the given characteristics, the following table is presented. In it, each of the techniques mentioned is listed horizontally and the characteristics, vertically. In each block of the table are found evaluations of one characteristic of each technique. (Miscellaneous techniques have been omitted.) Discussion of the table which follows by characteristic. All techniques are examined and compared in terms of each characteristic.

1. Kind of Information

The kind of information obtained from each technique is slightly different. In force field analysis a complete description of impinging variables is generated, while with brainstorming and nominal group a rank-ordered list of solutions is produced. Completely integrated planning models for bringing about change are the end product of synectics and simulations, including a time frame and identification of persons to coordinate different phases of the implementation. Force field, nominal group and synectics include feedback and discussion among group members which tends to generate support of the program which is developed by the group. Only force field is promoted as a good method of eliciting feelings and attitudes.

2. Effectiveness

Effectiveness is perhaps the most important characteristic of these techniques because it really means, "how good is the method?" Brainstorming does

produce some highly novel solutions, depending on how well the group is run and the influence of different members of the group. Force field analysis is reported effective at identifying forces, assuming group members are honest. Nominal group is efficient and effective when used to explore problems. With synectics, one uniform solution is obtained, but its effectiveness depends on the ability of all group members to use the technique. With simulation the problem-solver can experiment, can consider all variables simultaneously, and obtains results fast and efficiently.

In research on the effectiveness of these techniques. considerable variability has been reported. Very little research has been done on synectics and force field, so only the recommendations of pleased users are available. Much more research has been done on the remaining techniques. Brainstorming has consistently been found to be less effective than other group methods and simulations have been reported to have serious flaws, particularly when tried in educational settings. Most of the studies of nominal group have reported favorable results, but most of the studies have been done by those who developed the technique in the first place. Has the lack of research developed a real case against synectics? Which is preferable, a technique about which much is known to be unfavorable or a technique which has not been carefully scrutinized?

3. Flexibility

The flexibility of each technique, its ability to be used over a wide range of educational settings, varies greatly. The first three techniques, brainstorming, force field, and nominal group, are quite general and would be appropriate to a wide range of settings. The latter two, synectics and simulation, are suited to more complicated problems though they have less often been used in educational settings and may be less appropriate to problems involving human variables. In thinking about flexibility it is important to consider the complexity of the problem, for there is no need "to swat a fly with a jack hammer," that is, to use simulation when force field would suffice.

4. Complexity

With respect to complexity, the techniques discussed again cover a wide range. With brainstorming, force field, and nominal group, anyone who has some familiarity with the problem under consideration can effectively participate in the group process. The first two rely on natural leadership, though experience in directing groups would be helpful; managing a nominal group is only a bit more demanding than the first two.

Simulation and synectics are much more complex. Simulation requires a logical mind and some understanding of how algorithms function and how a computer works generally; computer language may be necessary. To participate or direct a synectics group requires skill in using analogy, simile, and metaphor which may necessitate a course in the technique or experience using it. Since the skills developed by the two more complex methods may be applied to other problems, the extra time and effort may be justified.

5. Resources Required

In looking at the resources required by each technique listed in the table, it appears that the first three are "cheap" and the last two expensive. Actually, there may be more similarity in resources than a quick glance indicates. If the particular situation is very complicated, brainstorming, force field and nominal groups can require many hours, days or weeks and the group still may not formulate any viable solutions. Synectics and simulation may be quite inexpensive if courses or consultants and computers are readily available. When considering resources and costs it is well to remember that the quality of the product, in education as elsewhere, is directly proportional to the resources allotted it.

In summary, a range of techniques has been presented in this paper because it is assumed that some variety exists among the local education situations in which these techniques might be applied, from small rural school systems in which few if any handicapped students are served to large urban systems which already have vocational programs in operation. Which technique to use for identifying alternates to the barriers to vocational education for the

handicapped depends to a certain extent on local variables and how far the system has moved toward its goals in this area. Is the system just beginning to identify barriers or does it already have a program? Is that program meeting existing needs? Another local variable is the number and kinds of personnel that can be made available to tackle the problem. A third consideration of course is the amount of time and money a system can spend on this task.

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APPENDIX A

List of Rejected Techniques and Reasons for Omission

Technique	Reason
Consultation	Need input from many sources
Derivation Conference	Not enough information
Systems Analysis	Too broad for specific task
Community Forums, Charettes	Need better informed participants
SIR	Suitable for concrete business problems, not "people" problems
SAMM (Science-attribute/ Modifications Matrix)	Product-oriented
Questionnaires, Surveys and Checklists	Need discussion to refine ideas
Delphi	Need input from "non-experts"; concensus not crucial
Role-playing, psychodrama or sociodrama	Many problems rather than one
NTL Sensitivity group training	Task-oriented, not group maintenance problem
"Fish bowl"	Not enough information
Gordon method (idea hooks)	Problem less concrete than Gordon's

COSTING AND RESOURCE ALLOCATION

by

Rose M. Etheridge

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SYSTEM SCIENCES, INC.

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I. INTRODUCTION

The Education of All Handicapped Children's Act, P.L. 94-142, has mandated the right of all handicapped children to a free, appropriate public education in the least restrictive environment. The intent of the legislation is to offer handicapped students an appropriate education in the least restrictive environment in order to provide an opportunity for them to realize their full potential. Education for handicapped students in the past has too often been absent altogether or so isolated from the regular education system that it functioned in many respects as a barrier to successful integration into society. Many educators and lawmakers alike have now realized that it is much more beneficial to the individual and to society to provide as fully as possible for the handicapped people those educational opportunities that ease the transition from school to community. Not only is this now a basic, inalienable human right in the humanitarian and legal sense, but it is also more cost-effective in the long run to society to have individuals contributing to economic and social growth rather than receiving from already burdened welfare institutions.

In addition to P.L. 94-142, several other pieces of legislation speak to the issue of accessibility to education for the handicapped. Amendments to the Vocational Education Act of 1963 gave high priority to the provision of vocational education to handicapped and disadvantaged people. Provisions were inserted to "encourage the states to deliver services to students who could not succeed within the regular vocational curriculum" (Hoffman, 1975). In addition, Section 504 of the Rehabilitation Act of 1973 contains requirements that programs be accessible to handicapped students in an effort to provide them with a full range of educational opportunities designed to meet their unique needs.

Aside from the legal constraints within which schools must operate, schools are being increasingly held accountable by the public for their actions. They are frequently asked to justify decisions concerning programming and resource allocation as well as to provide evidence that goals and objectives are being achieved. Schools have found themselves in the middle of an accountability push on the one hand and a condition of increasing resource scarcity on the other hand. While the law and the public are demanding better performance from schools, there are budget cuts from government and community revolts against increased taxation and spending. Schools are asked to deliver more and more with less and less.

It is estimated that in order to provide education to handicapped children ages 5-17 at the present level of quality, $2.5 billion per will have to be added to national education expenditures. Since P.L. 94-142 extends services to handicapped students to age 21, expenditures could be enormous. How will the local administrator allocate funds to programs involving handicapped students and all the other programs under his/her direction? At the local level, choices must be made between: (1) expenditures on education versus other goods and services, and (2) the allocation of educational resources among the various alternatives within the school (Chambers, 1978). (For the purpose of the present discussion, issues of costing and resource allocation will be limited to the local school system.)

Increasing responsibility for these decisions and their consequences will fall on the educational administrator. Some suggest that technical specialists be hired to perform quantitative operations rather than providing opportunities for administrators to acquire new skills in resource allocation. Experience has demonstrated that in many situations where this occurred, administrators have relinquished control over decision-making to the technical specialists who sometimes lack the necessary training and experience in education to make the best decisions. Furthermore, technical specialists are often unfamiliar with the school environment and its political characteristics. As a result, they may create more problems than they solve.

To make rational decisions concerning matters of resource allocation, administrators need decision-making procedures to aid their judgment. The development of such procedures has accompanied the development of organizational management from the bureaucratic line-staff view predominant in the early 1900's to the systems approach common today. The systems approach to organizational management is based on a conception of the organization as a whole with all its interacting component parts interacting with parts of other systems. The systems approach contrasts sharply with a more compartmentalized view of the organization, a tendency to view decisions as isolated events rather than as components of a larger organization and societal system.

With the systems approach has come a tendency toward more rational decision-making. Rather than relying on habit and rules of thumb, administrators are increasingly seeking and using more systematic ways of structuring and arriving at decisions. Figure 1 below presents a summary comparison between traditional and modern decision-making techniques.

FIGURE 1. TRADITIONAL AND MODERN TECHNIQUES OF DECISION MAKING

TYPES OF DECISIONS	DECISION-MAKING TECHNIQUES	
	Traditional	*Modern*
Programmed: Routine, repetitive decisions Organization develops specific processes for handling them	1. Habit 2. Clerical routine: Standard operating procedures 3. Organization structure: Common expectations A system of subgoals Well-defined informational channels	1. Operations Research: Mathematical analysis Models Computer simulation 2. Electronic data processing
Nonprogrammed: One-shot, ill-structured novel, policy decisions Handled by general problem-solving processes	1. Judgment, intuition, and creativity 2. Rules of thumb 3. Selection and training of executives	Heuristic problem-solving techniques applied to: (a) training human decision makers (b) constructing heuristic computer programs

From: Simon, H.A. The New Science of Management Decision. Harper & Row, 1960.

The state-of-the-art of administrative decision-making in education appears to parallel the trends in administrative decision-making in general. According to Sharples, educational administrators are tending toward a more "rational" approach, although progress in this direction is proceeding more slowly than in many other disciplines (Sharples, 1975; 1977). The problems with the rational approach in education are particularly acute since existing variables are many and difficult to quantify. The current need in education is more precise measurement and more thoughtful linking of objectives, instructional strategies and outcomes. Rational decision-making procedures should aid administrative judgment, thus serving to communicate information to those to whom educational institutions are accountable (Johnson, 1976).

Well-grounded decisions in allocating resources play an important part in determining the success of an educational program. Studies attempting to relate fiscal expenditures to educational outcomes such as student achievement have produced conflicting results. Educators and the general public have long assumed a positive relationship between spending and quality of education. To the surprise of many and confirming the suspicions of a few, the Coleman report declared that there was no significant increase in student achievement associated with the common correlates of increased spending (smaller classes, higher teacher salaries). More critical variables were students' socioeconomic backgrounds and home environment (Coleman, 1966). These findings were substantiated by Jencks (1972) and the Rand Corporation report (Averch, 1972), the latter of which suggested that education expenditures could be be substantially reduced without serious deterioration of educational quality as measured by student achievement test scores.

Subsequent studies have seriously questioned the validity of these studies, citing methodological deficiencies as the major argument (Hornbostol, 1973; Heller, 1973; Walton, 1973). The Advisory Commission on Intergovernmental Relations acknowledged the contributions of the Coleman report while concurring with other critics about its

methodological problems. The Commission went further in its analysis of the money-quality relationship controversy and suggested that the way in which the money is allocated is more important than the amount of money per se (ACIR, 1973). The proper step, in other words, is to identify those areas most closely related to school achievement and allocate resources in that direction.

On the basis of these studies, the task of the administrator is at the same time more clearly defined yet more complex. Determining the costs of education is only the first step in allocating resources. More important is to develop a process for gathering relevant cost data and integrating them into a system for making projections and determining priorities. From this will come allocation decisions which increase the likelihood of significant educational outcomes (Bernstein et al., 1976).

The issue of accessibility to vocational education for handicapped persons involves more than integrating them into the "mainstream" and providing more of the same services offered to regular students. To comply with federal and state legislation, administrators must do more than merely increase already-existing services. Special attention must be paid to identifying unique learning needs of handicapped students and allocating resources in such a way that these needs are met. It is hoped that the ensuing discussion will assist in developing a planning model that will provide alternative means to fulfill accountability requirements and legal directives within the existing social and political constraints of the school system.

Goals and Objectives

The purpose of this paper is to identify procedures for use in estimating costs and allocating resources within the context of the legal and policy directives of the Vocational Education Amendments, Section 504 of the Rehabilitation Act and P.L. 94-142. The primary focus will be on costing and resource allocation used to remove barriers to program accessibility faced by handicapped students.

The discussion is intended to accomplish the following objectives:

(1) Summarize the literature in the area of resource allocation and cost analysis;

(2) Identify procedures used to allocate resources and estimate costs in education, special education and vocational education;

(3) Identify the range of methods useful for local administrators in allocating resources and estimating/analyzing costs;

(4) Identify needs in the areas of resource allocation and cost analysis; and

(5) Apply the range of resource allocation and cost-analysis procedures to established planning criteria and identify those procedures which fit the criteria.

II. METHODOLOGY

The approach to the issue of resource allocation and costing evolved from the general to the specific. Approaches/methods used in the area of administration were identified and then applications of these and others were searched for in education, special education and vocational education.

Concurrently with this effort, issues in mainstreaming and accessibility were identified, both in a general sense and as they applied specifically to costing and resource allocation. The search narrowed from a survey of the general planning issues to the identification of specific management decision-making techniques.

The study began with a traditional review of the literature. Approximately 400 sources were consulted through a combination of computerized searches such as ERIC, AIM/ARM, CIJE, and SSI, supplemented by a hand search. Various books, journals, articles, government documents, research reports and exemplary program summaries were consulted.

Communication was established with ongoing projects such as costing studies of the National School Board Association and the differential costs of vocational education study of Education Management Services, Inc. Additionally, newsletters of various state and national organizations working on the issue of accessibility and costing were obtained. Many of these were identified in HEW documents and publications, special-interest group journals such as Paraplegia

News and multidisciplinary journals such as Innovations. Several of these sources led to specific costing studies and exemplary efforts in coping with the accessibility issue.

Actual literature accessed was varied and crossed many disciplines. In addition to the general areas of education, special education and vocational education, other areas such as educational administration, education finance, personnel, guidance, health administration, mental-health administration, management science, public administration, economics, business, public finance, public relations, social welfare, vocational rehabilitation, sociology, psychology, organizational behavior, statistics, decision sciences, accounting, policy analysis, political science and planning were accessed.

Several consultants were involved as the study proceeded. Their backgrounds and interests were diverse, ranging from education to public administration, business, education finance, economics, and health administration.

In reviewing resource allocation techniques for discussion in this paper, three general guidelines were applied. First, there had to be sufficient information available about a technique in order to derive a description and evaluation. If a technique was not mentioned and discussed in at least two sources, it was regarded as inappropriate for the purposes of the present paper. Second, a technique must have had demonstrated effectiveness as a resource allocation device. If a technique had questionable technical validity and effectiveness it was excluded from consideration. Third, a technique must have some applicability in an educational setting. If it was clearly inapplicable, it was excluded from consideration. Finally, a technique had to be at a level of simplicity such that, given the traditional training and experience of an administrator, it could be taught in a reasonably brief period of time. If extensive training and experience in mathematics, calculus, statistics, operations research, etc. was necessary in order to use a technique, it was eliminated from consideration. (A list of techniques reviewed and rejected can be found in Appendix A.)

Once these guidelines were applied and initial screening completed, five other dimensions were selected as a basis for comparing the techniques selected. These five dimensions--information, effectiveness, flexibility, complexity and resources required--are combined in a summary chart/matrix and discussed in Chapter 5.

III. STATE-OF-THE-ART: DEVELOPMENT OF COST DATA FOR SPECIAL STUDENTS

During the pre-1950's era, only the most severely handicapped received attention in the schools. They were segregated into separate classes and assigned to a teacher who was often rewarded with a special supplement. If the teacher was fortunate, class size was reduced and special materials were provided. The "cost" of special education was figured on a per-pupil basis incorporating teacher supplement, class size and special materials provided.

From the 1950's through the 1970's handicapped students were relabeled and their treatment in the school system was changed. Handicapped students became "exceptional students" and they were increasingly integrated into the regular classroom. With the increased attention to individual needs came a shift from the one-teacher-per-classroom concept to individualized and varied programming to meet varied needs. Diagnosis by a team is now common along with a full complement of support staff.

Unfortunately, methods of collecting cost data have failed to keep pace with the change in programming. As Singletary (1976) observed:

> "It quickly becomes apparent to an investigator dealing with exceptional child programs that there is a paucity of information concerning the financing of such programs." (p. 334)

One of the pioneers in the area of program-cost differentials of exceptional versus regular students was Bentley (1970). In sampling 16 exemplary programs, he identified 8 categories of costs that contributed significantly to programming for exceptional students. These were (high to low in order of degree of consistency across districts): teachers, support services, instructional supplies and

equipment, operation and maintenance, program administration, fringe benefits, teachers' aides, and transportation. Teachers and instructional-staff salaries are the most expensive items in school budgets. Approximately 75-80% of a typical school's operating budget is allocated for salaries (Rossmiller and Geske, 1976).

The National Education Finance Project, completed in 1970, attempted to develop a program-cost differential methodology and encountered difficulties in efforts to identify costs relating to special students. Pupil, personnel and fiscal accounting records were not maintained on a program basis (Rossmiller et al., 1970). In fact, the literature in the area of school finance and costing rarely treats programming as a fiscal issue (Bernstein et al., 1976).

This is particularly unfortunate since programming is one of the most critical variables affecting the cost of serving handicapped persons (Bernstein, et al., 1976). Data as to type of handicap are apt to provide little insight as to true cost. Individuals vary so widely within categories of handicap that programming cannot meaningfully occur on this basis alone. A severely physically handicapped student may require residential care whereas a student with partially restricted mobility may be capable of functioning well in the regular classroom.

Besides lack of data by program, many states have a more basic deficiency in costing in that necessary data in any form are often totally absent. A recent national survey of vocational education revealed that only 12 states had adequate cost data necessary for program planning (Hale, 1978). Data that do exist are often descriptive rather than normative, usually meaning that past rather than current costs are available, which typically does not reflect current need. It is common to find data in aggregated form which then must be manipulated and converted. Further, qualitative variables such as efficiency and feasibility are usually absent and therefore not systematically taken into account (Bernstein et al., 1976).

Other problems relate to accounting practices and difficulties inherent in the manner in which financial records are maintained. As stated earlier, accounting records are not always maintained on a

program basis. Accounting practices vary from simple line-item to extensive computerized program accounting (Management Sciences, Inc., personal communication). This variability is, in itself, a problem in that one district may not be able to obtain usable cost data from another district because of differences in the way financial records are maintained (Singletary, 1976).

Varieties of Cost

Although cost is a seemingly precise, quantitative term, it is more subjective than is ordinarily realized. It is important that the subjectivity of its conceptualization, computation and analysis be explored so that the educational administrator can make decisions on the basis of cost data and convey cost information simply and accurately to lay as well as professional people. For the administrator, cost is a conceptual organizer, a tool for ordering large amounts of divergent information in usable, comprehensible form. Cost is also, when appropriately analyzed and presented, a means of communicating with others. It can function as a language that communicates with some precision once its dimensions are defined.

In its most meaningful form, cost is more than expenses expressed in dollars. Costs can also be conceived as time and energy expended, pain and discomfort endured, and foregone alternatives. When possible, it is helpful to express costs in dollars since this is a common medium of exchange and most easily communicated and understood. This is not to imply that the only meaningful kind of cost data is that expressed in monetary terms, for there are many categories of qualitative data that cannot be reduced meaningfully to dollar figures. These kinds of data do not necessarily create problems in conceptualizing and figuring costs unless they are dismissed as "non-cost considerations." Qualitative costs are no less significant because of their nonquantitative nature; however, they must be handled in a different manner. Some data actually lose meaning when artificially forced into a quantitative framework. Consider, for example, the cost of a human life. Clearly the cost is more than foregone income figured in lifetime earning potential. The art of cost analysis lies in identifying key costs and knowing what qualitative data to leave in qualitative form.

There are several varieties of cost that the educational administrator will encounter in making program comparisons and resource-allocation decisions. The following list of cost categories is by no means exhaustive. It is rather a representation of the broad, categorical units into which costs are commonly organized. There are more specific costing terms used in an accounting sense that are beyond the scope of this discussion. Since accounting systems vary among school districts, any discussion around the topic would likely be inapplicable to most readers. Administrators are referred to Revised Handbook II, Financial Accounting Classifications and Standard Terminology for Local and State School Systems (U.S.O.E., 1973) and others in the State Educational Records and Reports Series. Most school systems now use some variation of the format and terminology suggested in these documents.

1. Opportunity Costs

When resources are used in a particular way, there is a cost involved in foregoing other ways of using the resources. Opportunity costs often are computed in terms of the maximum value of the next best alternative use of the resources in question. It is unnecessary to include all possible opportunity costs; only those relevant to the question under consideration need be computed. It is especially useful to consider opportunity costs when the supply of inputs (resources) is limited. If an administrator finds, for example, that an alternative program has more value than one presently in operation, he/she may decide that the opportunity costs of the program in operation are too great to justify its continuation. The next logical decision to make would be to put into operation the alternative program with greater value for the same expenditure of resources.

There are circumstances where opportunity costs may equal zero. Consider the situation where an abandoned school building is to be used for a particular program. If there were no alternative uses for the building, the opportunity costs in using the building for the program would be zero. Such a situation does not frequently occur, however. As resources become increasingly scarce, it will become more critical to figure the opportunity costs of expenditures.

2. Relevant and Irrelevant Costs

Which costs are relevant depends on the decision to be made. If the decision in question concerns a choice between two instructional strategies, both of which are appropriate for classroom use only, then pupil-transportation costs are irrelevant. Not all kinds of costs are this clear-cut, however. Skill must be exercised in defining the boundaries of the decision under consideration.

3. Incremental Costs

Incremental costs are relevant costs and are sometimes referred to as marginal costs. They refer to the additional costs that must be incurred to obtain some additional item. For example, it may be useful to know the incremental costs of ordering instructional materials in units of 500 as opposed to units of 100. To do this, one would figure the ratio of additional dollar costs of one set of orders to the other.

4. Past and Future Costs

Future costs are those costs that will be incurred as a result of the decision to be made and are therefore relevant costs. Generally, past costs are irrelevant. They are costs that have already been incurred and do not accurately reflect true costs. Consider, for example, the costs of a new program. Past, and therefore irrelevant, costs include the costs of the building, utilities, already purchased materials and equipment that would be used for other purposes, and counseling time if students would spend the same amount of time in counseling regardless of the program. These are often referred to as sunk costs since they are not affected by the decision under consideration.

Past costs are not always irrelevant. If it can be shown legitimately that past costs are a true or accurate projection of future costs, then past costs, under this condition, are relevant. Given current and projected future rates of inflation, it is likely that most past costs are relevant only for use as a base for making adjustments. Future projected interest rates, inflation increases and changes in market supply as they affect demand and price are relevant pieces of information not revealed by past costs.

5. Direct and Indirect Costs

Direct costs are those costs that can be directly allocated to an activity. They have a direct and obvious link to the object or activity being costed. Examples typically include salaries, employee benefits, supplies, materials, purchased services and all items directly related to program activities. Indirect costs are those costs which cannot be tied to a program or activity. Examples include instructional-support costs (student counseling, health and psychological services, media, curriculum development and staff training) and general-support costs from other departments. Depreciation and employee benefits are sometimes listed here as well.

6. Fixed and Variable Costs

This dimension of cost depends upon the degree of variability of the cost in relation to the output or activity under consideration. Fixed costs usually do not vary with the decision to be made. They are independent of the scope and volume of the proposed alternative in question. Examples may include food, utility bills and transportation. Variable costs change as output or volume of the proposed alternative changes. Staff time and supplies may be considered variable costs if they change or vary as a result of proposed changes in program activity.

Some analysts further refine this dimension by including a category of semifixed and semivariable costs (Cleverly, 1978). These costs change with respect to changes in output but the changes are not proportional. For example, utility costs may be fixed to a point but then vary as program volume increases. Semifixed/semivariable costs may be categorized as fixed or variable depending on the boundaries (time, number served) of proposals under consideration. Relevant dimensions to consider in determining whether costs are fixed or variable are (1) time period and (2) range or volume of activity. Costs may be fixed or variable depending on the size and resulting relevance (or lack thereof) of these two variables.

7. Recurring and Nonrecurring Costs

If the administrator is considering extending a program or activity for a period of time, recurring costs would be the

relevant figure. For example, one would exclude equipment costs from consideration since it was purchased initially and does not have to be replaced on a regular basis. On the other hand, costs for equipment maintenance and repair should be considered relevant costs, especially if the program is to continue for a period of time.

8. External and Internal Costs

Those costs that fall outside the realm of the activity in question would be classified as external costs whereas those that fall within would be termed internal costs. It is necessary to look beyond the specific program activities for costs. There may be costs that other departments incur as a result of the program that are real and relevant costs. For example, if counselors are called upon to administer extra tests or commit extra time in some way as a direct result of a particular program's existence, these costs, although external, are nonetheless relevant.

9. Marginal Costs

Costs incurred as a result of marginal changes in a program are called marginal costs. Once a program is operational, it is often useful to identify the cost of adding one more student, one more unit of instruction, or one more instructional objective. Marginal costs typically relate to the volume or scale dimensions of the proposed activity.

This dimension becomes especially critical when the addition of an extra unit creates a need for significant program expansion and modifications. Consider, for example, the importance of marginal costs when computing the cost of adding one more sight-restricted student to a full-to-capacity woodworking course. Marginal costs could include costs for extra special equipment, space and instructional time and materials.

10. Development "Start Up" Costs

Costs in this category relate to the costs of establishing the technical expertise, space, facilities, etc. to carry out the program.

Included in this category may be in-service training for staff, workshops, labs, time spent in materials revision, equipment and space modifications, etc. Development costs are often ignored in figuring new program costs. This can be a disastrous oversight since these costs are sometimes extensive. It is also important to consider that development costs are nonrecurring or one-time costs and do not contribute to program costs once the program is in operation.

11. Investment Costs

These costs include such items as equipment and buildings. They are investments because they are not quickly used up and may remain for alternative uses once the program in question is discontinued.

12. Capital Costs

Capital costs and investment costs are sometimes used interchangeably. Capital outlay is another term frequently used in this context. Included in this category are facilities, land, equipment and transportation vehicles, with most capital expenditures occurring for facilities. These costs are considered investments since they are durable and have a long-expected life span. Like most investments, they typically involve an extensive commitment of financial resources and thus consume a large amount of planning and decision-making time.

A significant issue surrounding a school's treatment of capital costs is the depreciation factor. Should capital investments be depreciated over time or should they be considered sunk costs? If they are depreciated, should the depreciation be based on procurement cost or the cost of replacement? These issues are presently unresolved and different practices are in effect across the country. Some cost analysts suggest that in seeking resolution of these issues, the administrator should consider the audience for the cost information. If the adoption of a particular practice is of questionable accuracy and would serve to confuse rather than enlighten the recipients and users of the cost information, it could probably be omitted.

13. Operating Costs

These are costs that are incurred in using the program or keeping it in operation, a measure of internal resources consumed. Utilities, supplies, salaries, etc. may be considered operating costs. They are relevant and recurring costs but are separate and distinct from the development costs of starting up an activity. Operating costs for transportation may include administration, labor, benefits, bus operation, transportation contracts, rent, as well as indirect or general-overhead costs.

14. Avoidable Costs

Sometimes relevant costs are referred to as avoidable costs. These are costs that are affected directly by the decision under consideration. They can be eliminated or "saved" if the program in question is discontinued and will continue only if the program continues unchanged.

15. Total Costs

This category generally includes more than a dollar sum of costs; it includes nondollar costs as well. In figuring total costs, it is important to avoid double-counting. For example, if materials are purchased for a particular instructional strategy, materials cost are direct and relevant costs. If these same materials are used as well by the counselor in working with students in the program, these materials are not again costed in the counseling component of the program although the portion of the counselor's time spent with the program may be included and is not considered double-counting. Other factors to consider in total costs may include disruption of routine caused by the program, staff resistance, administrative reorganization, etc. These are costs that are difficult to express quantitatively yet are relevant cost considerations in resource allocation and programming decisions.

16. Average Costs

Average costs are computed by dividing total costs by the total units of output. Many authorities in the area of cost analysis suggest that average costs not be used for decision-making purposes since they

mask important differences. Much more valuable to the decision-maker are marginal costs and other disaggregated costs.

In looking at programs that differ in effectiveness, it is helpful to look at average cost per unit of effectiveness. It provides a means of looking at diverse programs; thus it is attractive to many administrators. It is recommended, however, that the scale of the program be taken into account when using average cost. A program intended to serve a small number of students would show a completely different average cost than the same program costed on a national scale.

17. Ordering Costs

These are costs that apply mainly to materials and supplies. They are the costs of getting an object or item to the school. They include the salaries of personnel involved in processing the paperwork and other transactions such as freight, dollar per unit, etc.

18. Carrying Costs

These are the cost of maintaining an item in the school's inventory. Relevant costs include foregone interest on money invested in the item, storeroom operation, security, record-keeping, maintenance, obsolescence, space rental, deterioration, insurance and depreciation.

19. Social Costs

Included in this category would be all those conceivable costs viewed from a societal perspective. They may include the costs of donated time, goods and services as well as the impact on students, the community, the environment or society at large. They are intangible and difficult to compute and therefore are often ignored. As discussed earlier in this section, they are qualitative costs and are not less significant because of their qualitative nature. In fact, one important social cost dimension, political cost, is so significant that it often outweighs all quantitative-cost considerations, even the most rigorous and complete cost-effectiveness study.

Variables Affecting Cost

Programming. As previously discussed, programming is one of the most significant variables influencing the cost of educating handicapped students. In addition to the program-cost components identified by Bentley (teachers, support services, instructional supplies and equipment, operation and maintenance, program administration, fringe benefits, teacher aides and transportation), there is another special concern in the light of the accessibility legislation: capital costs. McLure (1975) identified four categories of programming tied to capital costs:

1) residential facility;
2) regional facility to which students are transported;
3) facility integrated with regular school (including ramps, elevators, special rooms and equipment, self-contained classrooms and resource rooms); and
4) building renovations and additions.

As several analysts have noted, it is considerably less expensive to make accessibility modifications during construction than to add them later in the form of renovations or additions. A 1978 estimate by the National School Board Association for architectural-barrier removal was $1.7 billion total cost nationally, with an average cost of about $17,374 per building (NSBA, 1978). Formulas for estimating capital costs are probably not possible to develop since there are so many variables involved. Costs will vary by number served, differing needs, and the multiple functions which the facility will serve.

Since there were no provisions for federal financial assistance for new capital construction, school systems are understandably concerned. According to Section 504 of the Rehabilitation Act, any school system not in compliance with the program-accessibility requirements by June 4, 1980, is subject to withdrawal of federal funds. School systems are looking to other funding sources such as bond issues and tax increases. Others are attempting to devise creative methods of making programs accessible, such as flexible scheduling and pooling of resources across districts to establish regional facilities. A key phrase in the legislation is "program accessibility" as opposed to building accessibility. The legislative intent is not that schools make every

room in every building accessible; only programs are to be accessible. Consequently, schools have more flexibility with regard to programming and building modifications than was originally thought.

Some program alternatives can involve significant transportation costs. Regional programs may save significant capital-outlay costs but transportation costs may be great, depending on the distance to be transported as well as other variables which will be discussed shortly. Some systems are using transportation time for instruction as well, which, in effect, serves to lower total cost. Some students may spend two or more hours per day in travel time to and from regional facilities. Putting that time to good use, some systems are equipping buses with staff persons who cover curriculum units en route. In addition to transportation to regional centers, other program alternatives such as homebound and hospital instruction involve staff transportation costs. Costs of special materials and supplies as well as staff time are involved.

Franklin and Sparkman (1978) conducted a cost-effectiveness study of regular versus resource-room placement using a matched sample of 64 elementary-school students. The effectiveness measure consisted of gains on the Wide Range Achievement Test (WRAT) over a one-year period. Costs were analyzed according to (1) direct costs (those costs which could be easily associated with an activity: salaries, employee benefits, purchased services, and materials and supplies; (2) indirect costs/ instructional support (those services not directly associated with objectives but nevertheless contribute to their accomplishment): pupil services such as attendance, social work, guidance, health and psychological services and support services such as in-service training, program supervision, curriculum coordination; and (3) general support (indirect) services (costs incurred through operation and school-system management): expenditures associated with the board of education, superintendent's office, business office, central services and the principal's office. Equipment and capital outlay were also computed and valued at current replacement cost, a more meaningful figure than original purchase price. Resource-room costs were calculated on a per pupil basis whereas regular classroom costs consisted of the maximum budget per pupil for the 1976-77 school year.

The results of this study indicated that the resource room was a more cost-effective placement than the self-contained classroom. The mean per pupil cost in the resource room was about $1,312 compared to $2,830 for the self-contained classroom. Mean per pupil gains in achievement were greater in the self-contained classroom than in the resource room; however, the difference was not significant and not large enough to outweigh the larger effectiveness-cost ratio of the resource room. This study provided an economic rationale for mainstreaming. As Franklin and Sparkman summarize:

> "In terms of this investigation the least restrictive environment also means the least expensive environment with no difference in achievement gain." (p. 314)

This is not to imply that mainstreaming will be inexpensive or even cost-effective in the short run. It is important that the administrator be able to separate start-up/developmental costs from the more far-reaching and recurrent operating costs.

Transportation. Because transportation services are expanding so rapidly, costs in this area are spiraling. Transportation costs in 1977 were nationally about $900 million (Bernd, Dickey and Gordon, 1976). Variables such as number of pupils, number of handicapped pupils, sparcity of population and road conditions have been employed as components of transportation costs. Illinois has employed a weighted formula for transporting regular, special and vocational students. These were, respectively, $110.63, $912.91 and $149.02 (1976-77 data). Clearly, transportation costs in the context of mainstreaming will depend significantly on the number of handicapped and vocational students served.

Extensive modifications will have to be made for some physically handicapped students, teachers and staff, since some handicapped persons are more expensive to transport than regular students. Special lifts, ramps and seating arrangements will have to be made to accommodate these students unless an alternative to bus transportation is devised. A recent study estimated the average annual costs of transporting a physically handicapped student to be $2,200 while the average cost of transporting other special students was only $335 per student (McKeown, 1978).

The rapidly rising cost of fuel plus other inflationary variables will contribute significantly to transportation costs in the years ahead, a fact obviously antiquating the above figures. Researchers in the area have encouraged that transportation costs be contained where possible by interdistrict sharing and contractual arrangements as well as by the creative and imaginative use of transportation time for instructional purposes. Other suggestions include limiting the number of stops, using one bus for two routes, and using one large bus instead of two smaller ones for the same route (Johns and Morphet, 1975). Other transportation costs are sometimes overlooked but nevertheless contribute to total costs. Some students may require special trips for diagnostic evaluation and treatment and aides may be needed to provide assistance. Field trips and vocationally-related training (cooperative-education programs, for example) may entail transportation costs as well (McLure, 1975).

Equipment. Equipment costs for special and vocational students are substantially greater than those for regular students. Bentley (1970) found that instructional supplies and equipment were two of the most important variables in accounting for the differential costs of special education. It has been estimated that approximately 10-15% of the capital-outlay expenditures are for equipment, with variation depending on program type, grade level, and local economic conditions (Frohreich, 1975). The need for adequate, up-to-date equipment in vocational education is difficult to dispute. Considering the cost of retraining students who were trained on outdated equipment and the cost to society of an ill-prepared work force, it is not difficult to see that expenditures for equipment in vocational programs is a cost-effective measure (Frohreich, 1975).

These costs are especially burdensome to schools in view of the fact that states rarely provide support for capital outlays. It is critical that these costs be adequately documented lest the total costs of educational programming for the handicapped be understated. This documentation should also include allowances for equipment modification for the handicapped and compliance with OSHA regulations.

State Funding Practices. The manner in which states allocate funds for handicapped students affects costs in a variety of ways. Bernstein et al. (1976) observed:

> ". . . if a particular program were to be arbitrarily funded at ten times the funding of another service, it would eventually come to "cost" ten times as much and could thereby be justified by empirical data." (p. 304)

State fixed-funding formulas have substantial limitations which may either encourage unnecessary spending and thereby drive costs upward, or fail to fund at the level of need by ignoring important variables such as inflation and differences in the standard of living across districts and district size. Some states are employing expert opinion in their cost studies in an effort to overcome some of the difficulties inherent in the fixed-formula funding (Bernstein, 1976).

Various state-funding mechanisms exist nationwide, each state with its own unique system. While it is beyond the scope of this paper to cover each state's individual practice, they can be grouped into general categories. Their discussions below will show how these mechanisms affect the programming and costs of educating the handicapped.

a. Unit Financing. States using this mechanism reimburse districts a fixed sum for each designated unit of classroom instruction, transportation and administration. Some of the difficulties inherent in this approach are (1) states are motivated to increase class size in order to decrease costs; (2) small districts are unable to qualify for administrative and instructional-support units; (3) start-up funds are missing, especially a problem for mainstreaming programs; (4) students are inappropriately placed in a lower per pupil cost program when units are allocated for differing class sizes on the basis of disability; and (5) all programs are reimbursed identically regardless of cost and quality (Thomas, 1973).

b. Weighted Formula. Weighted formulas allocate a flat amount for regular per pupil expenditure plus an added amount (represented by a weight multiplied by the regular per pupil amount) which usually varies according to disability. Idaho, for example, counts each exceptional child as three regular students (Thomas, 1973). Florida, on the other

hand, assigns weights by grade and by category of exceptionality (Bernstein et al., 1976).

When weights are computed using national figures, these costs are usually obscured. As pointed out earlier, a self-fulfilling prophecy often operates whereby programs tend to cost what is allocated. Some analysts have suggested that cost differential needs to be computed on the basis of state figures rather than national ones to provide a more accurate estimation of need (Johns and Morphet, 1975).

There are other problems with the weighted formula. When state figures are used to compute weights, districts with higher costs may not receive adequate funding. Further, as in Idaho, if the same weight is used for all categories of exceptionality, districts are not financially motivated to establish programs for children with disabilities requiring larger expenditures. Finally, employing a consistent weight assumes that all needs within a category of exceptionality are identical, an assumption which largely defeats the goals of individualized programming and of attention to unique learner needs regardless of exceptionality (Thomas, 1973). As Bezeau (1977) observed:

> "Special education weighting factors have tended to solidify the previously existing inequality of opportunity rather than to compensate for it." (p. 511)

c. Percentage Reimbursement. Under this mechanism, schools are reimbursed a percentage of the full costs incurred in providing for handicapped students. In Wisconsin, for example, the state pays 70% of the costs of educating handicapped students (Bernstein et al., 1976). Although this method averts some of the difficulties of the unit and weighted formulas, it may encourage schools to place students in the least expensive program alternative regardless of need in order to decrease the amount of total fiscal obligation at the school level (Bernstein et al., 1973).

d. Reimbursement for Personnel. States using this method provide funds to school districts to offset the costs of hiring special staff. In Illinois, a particular amount is allocated per special-education teacher, school psychologist, special-education director, etc.

Under this method, mainstreaming programs may suffer financially if methods are not established to fund personnel who work with nonhandicapped students as well. If such a mechanism is absent, schools are faced with an incentive for special class placement. This method may also encourage larger class sizes to reduce per pupil expenditures and may neglect the costs of supplies, equipment and transportation (Thomas, 1973).

e. Straight-Sum Reimbursement. A straight-sum reimbursement formula allocates to districts a set amount for each handicapped child. In Arizona, for example, a set amount is provided for each Educable Mentally Retarded (EMR) student, and other amounts for emotionally, physically, multiply handicapped, Trainable Mentally Retarded (TMR) and homebound ones (Bernstein et al., 1976).

Although a set number of students is not required for funding, labeling and fiscally advantageous placement may be encouraged instead of mainstreaming and placement according to educational need (Thomas, 1973).

f. Excess Cost. This formula incorporates cost estimates of educating a handicapped student in a district and subtracts from this the cost of educating a regular student. The excess cost is then reimbursed by the state. North Carolina uses this method. Cost components may include administrative services, staff salaries, transportation, ancillary services, instructional materials, and, in some instances, capital and construction costs.

In theory, excess-cost formulas encourage states to make the best instructional placement since financial barriers are, in many respects, removed. Problems occur when reimbursement occurs on the basis of a percentage of excess cost. In this instance, the same problems occur with excess-cost reimbursement as occur with other methods of financing (Thomas, 1973).

The greatest difficulty is in determining the components of excess cost. At present no precise technique exists to determine its makeup (Marinelli,

1975). Distinctions need to be made between operating and start-up costs, particularly with respect to mainstreaming programs. Also, the method by which indirect costs are charged against special programs can have a significant bearing on the magnitude of excess costs and resulting cost indices (Marinelli, 1975).

Two new methods have been developed for determining excess costs. The step-by-step method computes excess cost by delivery systems within categories of exceptionality. Incidence rates, program alternatives and price levels are used in the computation (Taylor, 1973). An accounting-system model developed by Ernst and Ernst (1974) computes excess costs on the basis of planned versus actual use of resources and cost per 10 minutes of instruction. The model allows for scrutiny of deviations from planned use of resources taking into account student enrollment, resource-mix consumption and price changes. The accounting-system model is more a management-control device rather than a method for estimating future costs. Further, accounting requirements are great and associated costs are high, leaving its utility as a costing device in question. Both the step-by-step and the accounting-system model use historical data which do not reflect current and future need (Marinelli, 1975).

Federal Funding Practices. Over the past decade, the proportion of federal aid to education has been steadily decreasing, reaching a peak in 1967 of 16% of total expenditures to about 7.8% in 1975-76 (Weintraub et al., 1976; Goertz et al., 1978). These figures are only averages, however. Some states receive more than 15% of their educational costs in federal funds while other states receive less than 4.5% (Goertz et al., 1978). Although the proportion of the federal share has decreased, the total amount of federal assistance has increased from about $760 million in 1961 to 4.2 billion in 1974 (Goertz et al., 1978).

The pattern of federal assistance to states for education has been of a categorical nature. Since 1972-73, however, the trend has shifted from categorical aid to federal revenue sharing (Weintraub et al., 1976).

One educational "category" that has not received cutbacks has been education for the handicapped. The federal share of educating the handicapped is currently about 12%.

Federal aid to states for educating the handicapped has been intended to serve as a catalyst for stimulating the development of programs and services for the handicapped. Unfortunately, the very nature of federal funding practices and the lack of enforcement of federal guidelines and policies have encouraged states to channel their efforts more in the procuring of federal funds than in judiciously and equitably implementing federally supported programs.

Vocational Education Amendments of 1968

The Vocational Education Amendments intended that states devote some of the money appropriated under the act for vocational education for the handicapped. To do this, the act specified that 10% of the money allotted to each state be "set aside" for this purpose. The intent of the legislation, in addition to providing a wider range of vocational training and the development of new vocational-training programs for the handicapped, was that the 10% set aside would inspire state matching. The federal support was intended to serve as seed money for follow-through state effort. A follow-up survey of states conducted by the General Accounting Office found that the provisions of the act failed to create the intended state incentive. The study concluded that:

1) An overall average of 11% was spent for the handicapped.
2) No state over a four-year period supported efforts for the disadvantaged and handicapped to the same extent as its overall Part B program.
3) While the nationwide average ratio of state and local funding for all Part B programs in fiscal year 1973 was $5.93 to $1.00, the ratio for programs serving the handicapped was only $1.10 to $1.00.
4) In fiscal year 1973, 19 states spent fewer state and local dollars for every federal dollar for the handicapped than they had in fiscal year 1970.
5) Some states, over a three-year period, spent no state or local funds for the handicapped while continuing to receive federal assistance for such programs.

6) In other states, state and local funding has been withdrawn as federal funding has increased.

(Weintraub, et al., 1976, p. 185)

Another follow-up effort by the Council for Exceptional Children confirmed the GAO findings. The majority of vocational offerings were found to be limited with the handicapped located in segregated programs. Another finding of interest is that handicapped enrollment declined in the period 1971-73 in spite of increased federal expenditures (Olympus Research Corp., 1974).

The failure of the 1968 Vocational Education Amendments to create state incentives for providing vocational training for the handicapped can be partially attributed to the lack of federal monitoring and no required match. The 1976 Education Amendments included this requirement. Learning from this experience and other past failures, authors of P.L. 94-142 have made specific requirements and provisions for their enforcement as a strong component of that legislation.

The Education of All Handicapped Children Act of 1975 (P.L. 94-142)

P.L. 94-142 is essentially an excess-cost allocation mechanism. The law defines excess cost as:

> "those costs which are in excess of the average annual per student expenditures in a local education agency during the preceding school year for an elementary or secondary school student, as may be appropriate, and which shall be computed after deducting a) amounts received under this part or under Title I or Title VII of the Elementary and Secondary Education Act of 1965, and b) any state or local funds expended for programs which would qualify for assistance under this part or under such titles" (Part B, Sec. 611).

As an excess-cost mechanism, it is subject to all the advantages and disadvantages discussed earlier under excess-cost funding practices of the states (see p. 24).

The fiscal allotment to each state is made on the basis of the number of handicapped children being served in each respective state. There is the added specification, however, that the number in any state may not exceed 12% of the total number of children between and including the ages of 5-17 years in the state. Further, children with specific learning disabilities may not exceed 1/6 of the percent of children ages 5-17. Presumably the purpose of such specifications is to discourage

indiscriminate labeling by states for the purpose of procuring federal funds. Experience may prove, however, that the numbers spelled out in the law may be unnecessarily restrictive for some states.

Summary

From the foregoing discussion, it is clear that the costs of accessible education for handicapped students will vary substantially by program alternative. Since actual figures become quickly dated, it is more important at this point for the administrator to have a process/approach that can be used indefinitely to collect cost data and integrate them into a planning system.

At the federal level, there exists a need for allocation mechanisms which take into account states' existing financial resources and the number and characteristics of their handicapped population. Realistic expectations of state effort as well as enforceable legislation/directives may be the most expeditious means of stimulating state initiative in providing full vocational-education opportunities for the handicapped.

At the state level, an equitable resource allocation system is needed, supported by a costing methodology which incorporates the unique needs of school districts (Berke, 1975). Some analysts suggest that states compile cost studies 5-6 years in advance in order to adequately plan for future educational needs (Johns and Morphet, 1975). State-funding formulas should be developed which encourage programming on the basis of individual learner needs rather than financial expediency alone.

At the school-system level, there is a need for determining costs of educating handicapped children within various delivery systems. More cost-effectiveness studies are needed to supply data for planning and programming.

Current cost data are inadequate in many states. Some school districts have developed Management Information Systems (MIS) for collecting, storing and retrieving cost data. Other smaller districts have developed manual systems which are adequate to meet their needs. Computerized MIS's are not always the most cost-effective way to collect,

store and use data.

An important element of a good costing mechanism is an accounting system consistent with cost-data requirements. Line-item budgeting, while acceptable in the past, is no longer adequate for current purposes. Administrators who abide by the Revised Handbook II regulations generally have a useful and workable accounting system.

Although much of the foregoing discussion has centered around costs associated with handicapped students, a comprehensive approach to costing should be the goal. Rather than viewing costs associated with special students, vocational education, etc. as isolated pieces of information, it is more important to look at the mechanism for gathering the data and utilizing them as part of a total planning process. Buildings, equipment, transportation and programs will have to be flexible enough to serve multiple purposes. Education appears to be moving away from the use of labels for students and, consistent with the concept of equal educational opportunities, moving more toward viewing each child as unique and deserving of individualized programming. It is recognized that even students falling into the "regular" category may, at some point, if only temporarily, require the services that have been traditionally reserved for "exceptional" students, such as resource-room placement. Viewed in this way, accessibility costs can be spread across the student population rather than being assigned to a few students.

There is a need for more research on variables affecting costs. As these are identified, school systems will need information concerning simplest and least expensive ways of incorporating them into their financial systems.

There is also the problem of historical cost data and the challenge to devise ways to make them more useful. In order to make the most of the data present accounting systems offer, there must be ways developed to process this information so that it accurately estimates current and future costs.

Finally, there is a need for incorporating qualitative variables in the process of cost analysis and resource allocation. As emphasized earlier, the most sophisticated costing studies that fail to acknowledge

and accommodate political forces as well as other qualitative dimensions of the school environment often fail in their mission. As Fielden et al. (1978) suggested:

> "The audience for the analysis is a key factor since, . . . different levels have different perceptions of cost, varying political control over cost categories and a greater or lesser interest in certain cost elements. All these points will be relevant to cost methodology." (p. 24)

Najaar (1978) has proposed "substantive synergistic budgeting" as an alternative to the total fiscal approach frequently surrounding the analysis of financial issues. He argues that one must continuously examine the foundation on which fiscal decisions are based:

> "No formal tools of analysis that probe alternatives without questioning the very structure of objectives and programs behind them can be of help in answering this [resource allocation] question." (p. 511)

The challenge is in incorporating these qualitative dimensions without information overload.

IV. RESOURCE ALLOCATION TECHNIQUES

Resources have traditionally been discussed in terms of infinite availability. The very policies upon which the educational system was developed and the goals which it set were established under conditions of plenty (Wiles, 1975). In the post-sputnik era, we have come to accept a condition of limited resources. In fact, it would not be inaccurate to say that for the last 10 years we have been operating in a condition of true resource scarcity, a condition that is predicted to be a fact of the future rather than a temporary, passing phase.

Faced with the fact that resources will not be forthcoming for the asking, education administrators now find that they must "tighten their belts," make better use of the resources already available, and justify carefully requests for additional resources. Resources must now be conceptualized in terms of finite quantities and policy constraints.

The purpose of this section is to describe resource allocation techniques used successfully in education. They may help the local

administrator to cope better with the changes and decisions that accompany the mainstreaming and accessibility legislation in the context of resource scarcity.

Many of the techniques described had their origins in business and industry and have only recently found their way into education. They must be applied with caution and results interpreted in context if they are to yield useful information. Educational administrators have been unable to apply much of the business and economics decision models due largely to basic differences in the theoretical assumptions on which they are based. Education does not conform to the traditional market model. Education produces goods which have many nonmarket costs and returns (such as esteem, quality of life, etc.). Secondly, educational objectives do not revolve around profit maximization. In fact, education may come under severe criticism for unused allocations since this represents students unserved. Finally, unlike business, the quality of services rendered is often more important than quantity. This will be increasingly true as overall enrollment continues to decline (Fox, 1972).

Many of the techniques that follow have been adapted with varying degrees of success for use in educational settings. The administrator is encouraged to fit each technique to his/her particular situation.

Guidelines and other dimensions applied as criteria for selection were discussed earlier in the paper. The reader should refer to Chapter 2, Methodology, for that discussion.

Of the 50 techniques reviewed, 12 were selected for inclusion in the discussion that follows. Since school districts vary widely in their administrative structures and the technical support available, some techniques are clearly inappropriate for small school systems. Some techniques are also cumbersome in terms of administrative implementation. To the degree possible, limitations of each technique have been noted. It is left to the administrators to determine if techniques are applicable to their particular circumstances.

All the techniques included in this discussion are highly dependent on the Management Information System (MIS) operational in the school system. An MIS need not be computerized. In fact, many manual systems work well for small schools. Without an MIS that is at least moderately efficient, however, the administrator will find it extremely difficult to apply these techniques efficiently and receive useful information from them. For those who desire further information on this subject, Appendix B contains a summary of the general characteristics of an MIS and some guidelines and suggestions for its efficient operation.

Once a workable MIS is in place, the administrator is then in a position to extract relevant data for decision-making purposes. The following section of this paper will discuss various resource allocation techniques, with the assumption that adequate data are available to the administrator for use with the techniques.

Cost-Benefit Analysis

Cost-benefit (C-B) analysis is a management decision-making tool that has come into increasing use in the last 20 years. The technique itself is not new, having first been used by a Frenchman, Dupuit, in 1844, in the context of a paper on the utility of public works. Research by the Rand Corporation in the 1950's formalized and refined the technique and did much to widen its applicability. With the initiation of the Program, Planning and Budgeting System (PPBS) in federal government by President Johnson came a need for procedures to tie together objectives and outcomes with corresponding costs in an effort to achieve greater accountability. C-B analysis was applied extensively in the context of PPBS, especially in the Department of Defense, and its use was quickly spread to other departments of government. Although PPBS has fallen somewhat from favor, C-B analysis has remained a popular resource allocation technique.

1. Description

C-B analysis can be described as a tool for evaluating a set of alternative courses of action, normally alternative programs. Rather than a discrete set of procedures, C-B analysis is more an approach to a

problem. It is a way of assessing the desirability of projects (Prest and Turvey, 1975). The technique is built on the assumption that all relevant alternatives are known and that the consequences of implementing each alternative are known, at least in principle (Rothenberg, 1975).

It considers long-range costs and benefits to society of particular expenditures and both costs and benefits must be expressed in dollar amounts if they are not already in such a form. Once all relevant cost and benefit dimensions are converted to dollar amounts, a benefit-cost (B/C) ratio is derived. Normally, the B/C ratio must exceed 1 in order for the project to be considered a good investment. A B/C ratio in excess of 1 is translated to mean that benefits exceed costs. In comparing several projects, that with the highest B/C ratio is, theoretically, the most desirable. Clearly, there are other considerations as well, such as political and administrative feasibility, that are typically excluded from quantification. It is here that C-B analysis approaches an art rather than a science.

C-B analysis is most appropriate where broad policy-level decisions must be made. For this reason, it is most commonly used in federal government and, to a lesser extent, at the state level. It is most useful where decisions have to be made whether to increase allocations to education, for example, or to defense or public welfare. It is most useful to local-level administrators as a public-relations device to demonstrate to the public, boards, county commissioners, etc. the benefits to society of investment in their particular program compared to some other alternative. In other words, it can be quite persuasive as an accountability device, particularly where resources are a constraint (Webb, 1976).

C-B analysis has been used extensively at the federal level to evaluate resource allocation alternatives such as the value of investments in education as opposed to alternatives such as defense, public welfare, health, etc. B/C ratios of educational programs for the mentally retarded have been examined as well (Conley, 1973). C-B analysis has been used as an accountability device at the local level and as a means of determining the costs and benefits to society of increasing the general education level of the population (Webb, 1974; Webb, 1976).

2. Strengths and Weaknesses

Strengths

1) Permits the comparison of several programs with different objectives.
2) Expresses abstract concepts in monetary terms which are easy to communicate to lay people.
3) Permits the comparison of several programs at once.
4) May serve the joint purpose of a program evaluation.
5) May serve as a planning tool.
6) Cost data collected can serve multiple purposes.
7) Can feed directly into certain phases of PPBS in school systems where program budgeting is being employed.

Weaknesses

1) Time consuming.
2) Costly. (Hartley (1968) has suggested that administrators do a cost-benefit analysis of doing a cost-benefit analysis!)
3) Often requires several people to conduct the analysis.
4) Users sometimes underestimate the importance of mathematical calculations and either do not do them or do a poor or incomplete job.
5) Users sometimes get so caught up in the quantitative aspects of the technique that they erroneously ignore the supporting qualitative information that is often as useful.
6) Users sometimes try to force extremely complex problems into a C-B framework when, in fact, some other means of analysis would have been more appropriate.

Cost-Effectiveness Analysis

1. Description

Cost-effectiveness (C-E) analysis is a technique derived from C-B analysis that was developed to accommodate those situations where C-B analysis was inappropriate. Rather than benefits, C-E analysis uses effectiveness as a measure of the degree to which a particular program has accomplished its objectives. C-E analysis is not bound to a monetary expression of cost and effectiveness relationships, allowing costs to be compared to test scores, rating-scale results, number of graduates, etc. From these cost and effectiveness comparisons is derived an effectiveness-cost (E/C) ratio. As with C-B analysis, the E/C ratio

should exceed 1 if the effectiveness of an alternative outweighs the costs. For program-comparison purposes, the program with the highest E/C ratio is the program of choice. Programs that are the most effective are not necessarily the most cost-effective. Only through the C-E ratio is the cost-effectiveness relationship apparent.

Typically, either costs or effectiveness is held constant in order for the E/C ratio to be valid and meaningful. In the "fixed effectiveness" approach, the level of effectiveness (an outcome measure) is fixed and alternatives are compared with respect to the likelihood that they will achieve this level at the lowest cost. With the "fixed cost" (or fixed budget) approach, expenditures are set at a specific level and the alternative of choice is the one producing the highest level of effectiveness.

Cost and effectiveness considerations are typically short-range in contrast to the long-term time dimensions of C-B analysis. Although it is not necessary to convert effectiveness measure to dollar figures, it is possible to do so in the second phase of the analysis. Thus, C-E analysis has more flexibility than does C-B analysis (Levin, 1975).

C-E analysis has widespread applicability to a broad array of resource allocation decisions. Its use is appropriate where a choice must be made between two or more alternatives and cost and effectiveness measures are available for each alternative. It is appropriate in analyzing situations in which effects of alternatives are similar (Dunlop, 1975).

C-E studies have been applied to almost every aspect of education where resource allocation decisions have to occur. Examples of past studies include C-E investigations of self-contained vs. regular class placement with resource room, different levels of teacher preparation, technical-school education vs. high-school education and various program and instructional-strategy comparisons (Franklin and Sparkman, 1978; Wolfe, 1977; Kim, 1977; Hartley, 1969). Other studies have concentrated on alternative transportation strategies, food service, support services, etc.

2. Strengths and Weaknesses

Strengths

1) More flexible than C-B analysis.
2) Can enable the administrator to determine cost per unit of effect.
3) Can accommodate different quantitative units of measure in the same analysis.
4) Can be meaningfully incorporated into a programming, planning and budgeting system (PPBS).

Weaknesses

1) It is difficult to determine the effectiveness of a program over time with this technique (Dunlop, 1975). Assume the effectiveness of a program was major, but it occurred several years later compared to other programs whose effects were more immediate. C-E analysis could not account for this time-delayed effect in the form of a meaningful comparison between programs.
2) Cannot meaningfully be used in comparing programs whose outcomes/effects are different in kind rather than degree.
3) The use of the fixed-effectiveness approach has been criticized due to problems with using single measures of effectiveness. It is argued that any program produces multiple changes in students which are not distinguished by a single measure (Curtis, 1972).

Programming, Planning and Budgeting System

1. Description

Programming, Planning and Budgeting System (PPBS) is a resource allocation and planning device which incorporates elements of systems analysis and cost-effectiveness analysis. It is a system for "choosing among alternative ways to allocate resources to achieve goals and objectives" (House, 1972). The procedure had its beginnings in federal government in the 1960's in the Department of Defense and from there spread to all other departments of government.

The essence of the technique lies in its emphasis on budgeting by program rather than on the traditional line-item basis where costs are separated by object of expenditure (such as staff, supplies, equipment). In separating costs/expenditures by program, organizations are able to tie costs to objectives and activities designed to achieve those objectives (Hartley, 1968; 1969).

A PPBS is implemented by developing institutional goals, measurable objectives, and a set of activities designed to meet those objectives (i.e., a program). From these, program packages are developed which in a school setting describe course content, objectives and methods of evaluation. Once the programs are adequately described and budgeted, they can be subjected to a cost-effectiveness (C-E) analysis and prioritized for funding purposes (Mann, 1975). In general, the quality of PPBS improves as the range, detail and quality of the data increase. Too much detail reaches a point of diminishing returns, however, in terms of benefits whereas too little specificity undermines the purpose of PPBS. It is critical that a PPBS be intimately linked to a workable Management Information System (MIS). When developed in conjunction with the PPBS, an MIS can provide useful input into the system and prevent problems resulting from an insufficient or inappropriate data base.

PPBS has not had the overwhelming success that was originally anticipated. It is implemented most successfully when developed in conjunction with an MIS and a renovation of the accounting system. In this way, necessary data can be made available without undue tedium and expense. It is often unnecessary to do away with line-item budgeting. Often boards and other groups require line-item breakdowns for planning and decision-making purposes. A technique called "crosswalk" has been successfully employed to convert a program budget to line-item and vice versa to meet varying needs within the organization.

PPBS is well-known in almost all areas of education at present. Although few states have fully implemented the system, many districts (Florida, Philadelphia, New York City, Fairfax, Virginia, and California) have some form of it operational (Landers and Myers, 1977). In some states, it is required by law (Hughes, 1975). Unfortunately, some schools claim to be using PPBS but in fact have only renamed their old line-item budgeting system. As many school systems know, it is quite possible to develop a spectacular PPBS on paper while in practice continue with the line-item system.

2. Strengths and Weaknesses

Strengths

1) Increases the likelihood of shared goals within the organization.
2) Allows important organizational decisions to be made in an orderly, long-term process rather than in an atmosphere of last-minute crisis.
3) May contribute to more efficient organizational control.
4) Can improve staff and community motivation.
5) Serves as an accountability device
6) Can provide evaluation and planning information.
7) Provides decision-makers with new options.
8) Allows for public participation in school policy development.
9) Provides a framework for the accumulation of cost data over a period of years to aid in long-range decision-making.
10) Allows more flexibility in planning and use of resources.

Weaknesses

1) Has extensive data requirements; impractical without the aid of a computer.
2) May produce little or no change if inadequately implemented.
3) Requires specially trained staff, especially to figure costs.
4) PPBS participants may disagree on goals and objectives.
5) The problem of measuring affective components of educational objectives and costing them.
6) May produce rigidity if objectives are too tightly bound to those that were initially developed.
7) May require extensive paperwork and time.

Systems Analysis

1. Description

A "system" can be defined as "a set of elements so related that a change in the state of any element induces changes in the state of other elements" (Schaefer, 1974). In attempting to describe a system, one can approach the problem by identifying the elements or components of a system, using the aforementioned definition as a guide. For example, in describing a school system, one could identify a person as part of

the system based on whether that person's absence, illness, etc. would have an effect on others in the school "system."

A systems analysis is a way of attacking a particular problem area in a system, whether the problem is one of severe organizational dysfunction or merely a resource allocation problem.

More than a set of tools or techniques, systems analysis is commonly regarded as a way of thinking or a philosophy of life. It is an outlook rather than a theory in the pure scientific sense (Sherman, 1978; Rapoport, 1966). It is based on the concept of wholeness, that things should be viewed in their total context rather than as isolated components. Although traditionally associated with mathematical procedures and operations research, the use of quantitative devices is purely optional.

A systems analyst fully and comprehensively describes the system under consideration and identifies and examines the problem in the full context of the system in which it is located. The systems analyst would consider all the roles, structures and functions in the system that surround the problem and determine the nature of the interrelationships among these.

Once the problem and its context are fully described and understood, it is easier to generate alternative solutions and to choose a solution on the basis of its projected effect on the system as a whole. Models of each alternative under consideration are often constructed in varying degrees of sophistication in order to aid in this process.

The systems analyst, as a part of the analysis, would engage regularly in "iteration" or "looping back" to see that the system is working adequately. This is especially important during the strategy-implementation stage since every element of the system is likely to be affected in some way. To ignore those areas affected often invites the failure of a change. It is this monitoring function that the iteration process is designed to accomplish and, in this way, aids not so much in developing an initial solution but in implementing strategy.

Systems analysis is used in some form in practically every conceivable area. As Harley (1968) has observed, many educational administrators are probably using the systems approach and have for years without knowing it. Not that systems analysis is another name for common sense. On the contrary, it has become an organized way for expanding and ordering common-sense approaches to problems. Depending on the level of detail and comprehensiveness applied, systems analysis is appropriate for any resource allocation problem. As the level of detail employed in the analysis increases, its practicality as a resource allocation device for the education administrator decreases.

As a concept, systems thinking has been employed extensively in education for the last 15 or 20 years (Hartley, 1968). More recently, it has been applied to resource allocation problems (Rossmiller & Geske, 1976; Mann, 1975), instructional/personnel problems (Sherman, 1978), evaluation (Hayman, 1974), instruction (Maher, 1978) and others. It is practically impossible not to find at least a reference to the term in textbooks on educational administration. It is adaptable at all levels, comprehensive in concept and approach, and usable in some form by all administrators.

2. Strengths and Weaknesses

Strengths

1) Emphasizes a holistic, comprehensive approach to problem-solving; helps overcome shortsightedness, piecemeal efforts, and oversimplification.
2) Applicable at all levels of education.
3) Is a powerful decision-making tool with the proven capacity to produce change (Hayman, 1974).
4) Formulates decision problems in ways that are reasonable within the technology of current administrative decision-making.
5) Can serve multiple purposes (such as planning, management, control, resource allocation and evaluation).

Weaknesses

1) Complex, demanding and costly in its pure application.
2) Systems models may be incorrectly specified. Problems may be identified either too narrowly or too broadly.

Management by Objectives

Management by Objectives (MBO) was first developed and applied in an industrial setting as an outgrowth of the movement toward rational management. Its initial formulation is attributed to Peter Drucker who was said to have first used the term in 1954 in his book, The Practice of Management (Hacker, 1973).

1. Description

Problems in allocating "human" resources often do not fit into the quantitative dimensions of operations research-oriented management techniques. One way of formulating personnel allocation decisions is through MBO. The procedure involves setting goals or objectives by both the supervisor or administrator and the employee. Either may prepare the objectives but it is crucial that both parties agree upon them. Key components of the process are the statement, in specific terms, of the desired activity, who is responsible for performing the activity and when the activity will be performed (Mataliano, 1972). Some administrators include as well a monitoring device to insure that progress toward objectives is proceeding according to schedule. At the end of the predetermined time resulting performance is measured against the specified objective(s).

The assumptions are few and straightforward. Goals and objectives must be sufficiently concrete to be identifiable and clearly stated and they must be measurable. There is another implicit assumption as well. It is assumed that an employee's performance is enhanced by his/her setting goals and objectives for himself/herself. In other words, employees perform best when they are personally involved in creating their own goals, objectives and tasks.

As some writers have suggested, MBO, in its most useful form, involves a systemwide effort. It involves a careful and thorough analysis of the school system's goals and a development of an individual's goals and objectives from these in order to insure that there is a satisfactory fit between the individual and the system (Landers and Myers, 1977). Viewed in this way, MBO can also be conceptualized as a planning tool,

a way of developing future goals and activities for individuals that leads the school in the direction of its overall goals.

MBO is appropriate as a resource allocation and management device whenever there are personnel allocation decisions to be made and there is a commitment by the administrator to involve the personnel affected in the decision-making process. MBO is not appropriate in situations where personnel cannot realistically have a voice in matters that affect them. Neither is the technique appropriate for situations that do not involve personnel allocations. One would not, for example, use MBO for capital construction decisions.

When applied in educational settings, MBO is sometimes referred to as Educational Administration by Objectives. The concept, as a management device, was introduced first to educators through university courses in the late 1960's and early 1970's (Landers et al., 1977). A publication by the American Association of School Administrators in 1973 did much to inform education administrators about its potential use in education and has resulted in its widespread use (Knezevitch, 1973). Although referred to by various names to avoid the negative connotations MBO has acquired, several hundred school districts have implemented the procedure in various forms and many in the context of PPBS (Landers et al., 1977).

2. Strengths and Weaknesses

Strengths

1) Can improve performance by spelling out precisely what the individual is to do and when.

2) Can improve management and personnel relations by cooperative involvement and mutual acceptance of goals and tasks.

3) Can stimulate the creative use of human resources in a school.

4) Improves/strengthens management control and has potential for significant cost containment.

Weaknesses

1) Not learning from the mistakes of business and industry, administrators have sometimes distorted MBO by imposing objectives from above rather than viewing the process as a cooperative effort.

2) MBO can be viewed as a threat and disrupt ongoing activities if used as an evaluation device.

3) If the process is not clearly understood and accepted by the implementor(s), insignificant or trivial goals may be set in order to insure that all objectives are maximally achieved.

4) Does not handle goals and objectives very well unless they can be quantified and measured easily.

Program Evaluation Review Technique (PERT)

1. Description

PERT is a means of representing a large array of interrelated activities in a graphical network format. It is useful in the planning, scheduling, and control of programs and projects by providing an overall picture of activities and a meshing of time, cost and resource factors. It provides a degree of flexibility in resource allocation by allowing experimentation with elements combined in a model form. Through the use of PERT, administrators are able to anticipate problems and apply corrective measures. PERT can be thought of as a device for estimating the shortest possible time and minimum cost and resource waste of research goals and objectives.

A companion to PERT, the Critical Path Method (CPM) focuses on the time required to complete activities as well as the costs. Although similar, there are general differences in their approach. PERT uses three time estimates to form a weighted average of project completion time whereas CPM uses only one estimate. A further differentiation, as mentioned above, is that CPM allows for cost as well as time estimations whereas PERT deals mainly with the planning and control of time. Used together, they offer a potential tool for handling resource allocation problems.

At the completion of the PERT procedure, the decision-maker will have developed a network of sequenced activities comprising the project together with time estimates of each activity. Three completion time estimates are normally estimated for the network: optimistic time (of things sure to go exceptionally well), pessimistic time (assuming all went badly), and most likely time. A critical path is represented by

a line of activities in which no delays can occur if the project is to be completed on time.

PERT is most appropriate for complex or long-term projects in which decisions are directed toward reducing completion time and cost. Small-scale projects or activities that do not involve a large array of events and personnel can best be handled by another method.

The use of PERT in education has most frequently occurred with large projects such as school construction, reorganization or other multifaceted and time-consuming efforts (Tanner, 1971; Hostrop, 1975). It has also been used in managing contract negotiations, school-district management, facilities planning, task-force projects, and in-service training (Hentschke, 1975; Handy and Hussain, 1969; Tanner, 1971; Hostrop, 1975; Cook, 1966).

2. Strengths and Weaknesses

Strengths

1) Saves project/program time, optimizes resources and saves money.
2) Can be applied to almost any project requiring logical planning.
3) Aids in implementing goals and objectives efficiently.
4) Can be used as a device to forecast project/program costs.
5) Is adaptable to computer use.

Weaknesses

1) Time, cost and resource needs are estimates and are only as good as the thinking that produced them.
2) PERT/CPM only suggests corrective action; the details of how-to and follow-through rest with the administrator.
3) PERT/CPM are not applicable to repetitious tasks or those with less than ten discrete events. It would be more cost-effective to employ other, more simple techniques or variations of PERT to deal with these problems (Hostrop, 1975).

Decision Matrices

1. Description

A decision matrix can be thought of as a device for ordering and

displaying small pieces of information in a form by which their interaction with each other can be evaluated. These pieces of information are displayed in tabular form by rows and columns. Alternative plans of action are presented in rows and the important variables impinging on these plans of action comprise the columns.

Consider the example of the administrator who must choose an instructional strategy for a mainstreamed classroom. She/he first lists the criteria by which she/he will judge the instructional strategies. She/he may decide that it is important that the strategy be valid, that it have a proven capacity to impart material to handicapped students in a mainstreamed classroom. She/he may further decide that the instructional strategy must be administratively feasible, that it must be possible for the teacher to implement the strategy within the confines of the classroom. She/he may also decide that cost is an important consideration.

To add further power to the technique, the administrator may then assign weights to these three criteria in order to arrive at a quantitative answer. Assume, for illustrative purposes, that an administrator arrives at the following weights for the aforementioned criteria (a weight of three signifies "most important" whereas a weight of one is "least important"):

technological validity--3
administrative feasibility--1
cost--2

This is only an illustration. Different numbers could have been chosen depending on the degree of differentiation desired. The greater the range in weights, the greater the degree of discrimination among alternatives. At this point, the decision matrix may appear something like the one on the following page:

Instructional Strategy	Technological Validity (3)	Adminstrative Feasibility (1)	Cost (2)
Strategy #1			
Strategy #2			
Strategy #3			

The administrator may now wish to rate each instructional strategy according to the degree to which it meets each of the three criteria. For illustration, assume that each was rated by the administrator on a scale from 1 to 10 (1 being the poorest rating and 10 being the best). A scale of 1 to 100 could be used to produce greater discrimination, if desired. Once this is done, resulting ratings from 1 to 10 are inserted in the appropriate cells, multiplied by the weight for each criterion and a total for each strategy listed. The result might appear something like this:

Instructional Strategy	Technological Validity (3)	Administrative Feasibility (1)	Cost (2)	Totals
Strategy #1	4 (12)	6 (6)	5 (10)	28
Strategy #2	8 (24)	7 (7)	8 (16)	47
Strategy #3	10 (30)	8 (8)	4 (8)	46

Referring to the matrix, it can be seen that strategy #2 has the highest total, although strategy #3 is close behind. They are so close, in fact, that it is probably not wise to select strategy #2 on the basis of this decision matrix alone. Other factors such as political forces operating within the school and the community and personnel matters as well as student considerations should likely enter into the decision process at this time.

Decision matrices can be used when there are multiple plans of action to be considered, when multiple variables impinge on these plans of action, and when a choice is to be made among them.

Decision matrices are commonly known and widely used in practically all disciplines including education. It is a technique commonly applied to research and development projects and in situations where it is necessary to "optimize resources under given resource constraints" (Jantsch, 1969). In education, the technique has been almost exclusively used as a means of choosing alternative means of delivering already-identified technology rather than in generating new technologies within a cost-benefit framework. Its use for the local administrator in an educational setting lies more in the former area rather than the latter. It has practical value as a device for reducing costs and maximizing productivity.

2. Strengths and Weaknesses

Strengths

1) Enables the administrator to quantify certain aspects of the decision-making process. Areas of consideration are organized and systematically presented. As a result, the administrator should be better able to order his/her thinking and use the device as a rationale and justification for decisions.
2) Creates an awareness of the complexity of a situation while at the same time offering a framework for managing its diverse elements. These elements are broken down into component parts, often making the decision process seem less overwhelming.

Weaknesses

1) The technique is only as good as the information that was fed into it. If the person supplying the quantitative information is not

insightful in identifying the relevant dimensions of a problem, the technique will likely be useless.

2) Does not produce fine discriminations between alternatives. The administrator must determine those aspects outside the matrix format.

Decision Trees

1. Description

Decision trees consist of a graphical representation of a series of alternative decisions. Like PERT, it is a technique subsumed under the heading of network analysis.

The point at which a decision is to be made, a decision point, is depicted by a square. At this point, a finite number of alternative courses of action are presented and shown as branches emerging to the right side of the decision point. Where it is possible to do so, a cost associated with the decision may be displayed along the branch of each alternative.

In addition to decision points, chance points, designated by a circle, are displayed to signify the anticipation of the occurrence of one of the finite states of nature. These are displayed to the right of the decision points and are sometimes accompanied by an estimated probability of occurrence presented along the branch of the chance point.

Sometimes it is desirable to display with each decision alternative or state of nature an anticipated payoff along with the estimated probability of occurrence of each payoff. Payoffs may also be thought of as probable outcomes, depending on the nature of the decision tree and the purpose for which it was intended (Turban and Meredith, 1977).

When the number of alternatives is kept small, all computations may be done by hand. For extremely large and complex problems, however, it is necessary to use a computer. For many purposes, quantitative information may be omitted entirely, thereby eliminating the necessity of arriving at estimated costs and probabilities of occurrence.

In addition to resource allocation, the technique may also serve as a forecasting device when appropriate time parameters are included in the display. Figure 2 shows a simple decision tree constructed around

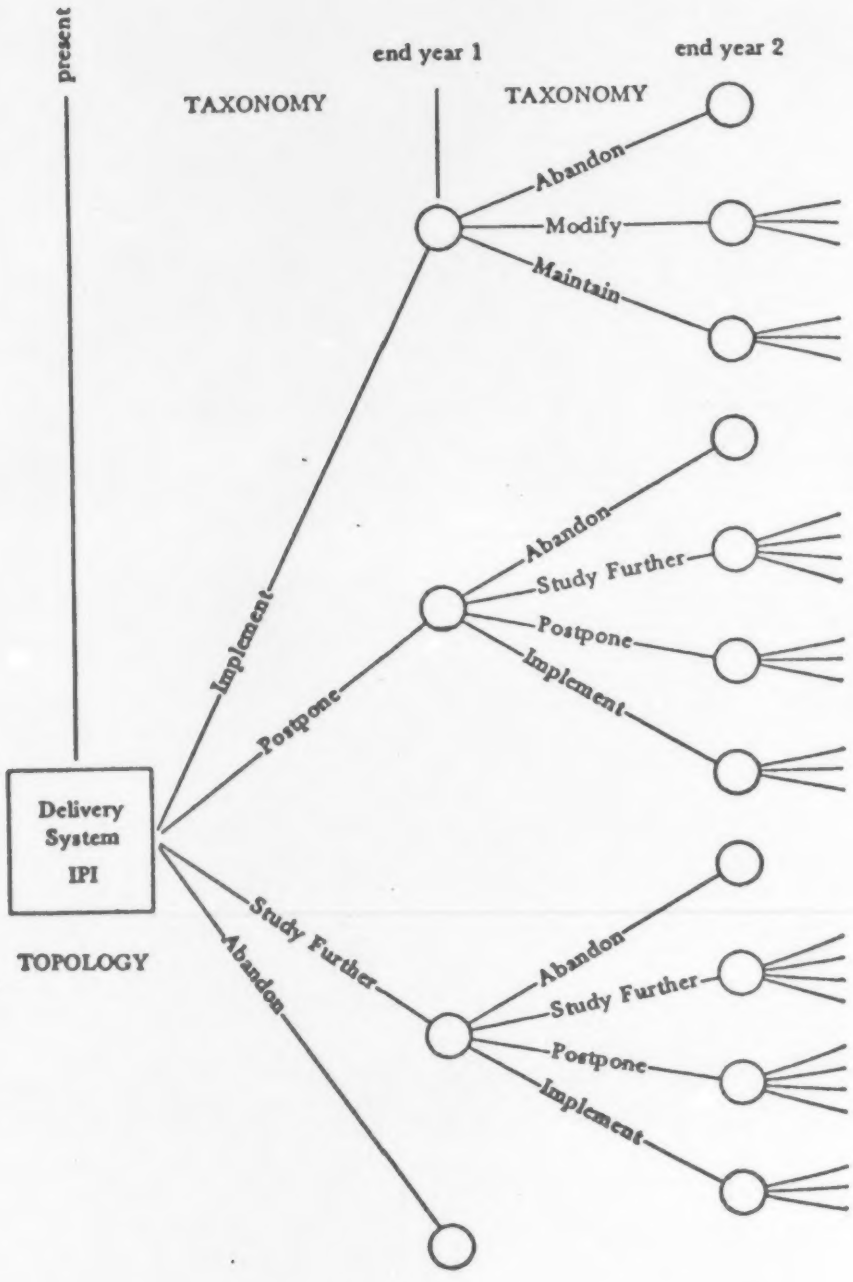

FIGURE 2

Decision Tree Display of Individually Prescribed Instruction

(McGrath, 1974)

the example of Individually Prescribed Instruction (IPI). A two-year time frame is built in to demonstrate the future-oriented conceptual approach that is necessitated by the addition of a phased-time dimension.

Decision trees are particularly useful when the decision-maker must consider an entire series of decisions simultaneously rather than a single alternative in isolation. When the number of decisions to be considered becomes too cumbersome for display in the form of a matrix, decision trees are often a useful alternative approach.

The applicability of decision trees to educational management is limited only by the assumptions of the methodology and the imagination of the administrator. The technique has particular applicability to personnel assignment and other resource allocation decisions (McGrath, 1974). Unfortunately, it has not been applied widely.

2. Strengths and Weaknesses

Strengths

1) Allows the presentation and consideration of a number of alternative decisions at the same time.
2) Forces the decision-maker to view the impact of a decision on others and to see the environment as a whole rather than an entity composed of isolated elements.

Weaknesses

1) Number of alternative decisions must be finite and, by necessity, small in number.
2) Important alternatives may be omitted by the decision-maker in the construction of the tree.

Budget Simulation

1. Description

Budget simulation is one of the most recent innovations in management science designed to serve a forecasting function. By varying the resource allocations in a budget, administrators are more able to determine impacts on various school programs. It is essentially a tool for exploring various ways of balancing a budget.

Once the simulation model is set up, it is one of the most efficient methods of examining the effects of various budget proposals. At the state level, simulation models have been developed which can reveal the impact on various districts of various changes in state school finance formulas (Stern, 1978; Johns, 1977). Simulation models at the federal level have been used to identify effects on states of various equalizing formulas (Nickens, 1977).

One particularly critical concern that budget simulation has been applied to is program budgeting. Many of those schools that do not use program budgeting and those that do use it only for reporting purposes are faced with the situation of having state funds allocated by program with accompanying requirements that a certain percentage of the funds be spent on particular programs. It is here that budget simulation has provided useful cost analyses and other information necessary for budget preparation.

Budget simulation is useful and appropriate for resource allocation decisions during the budgetary phase. Where various allocation alternatives exist, a simulation model can provide projections that aid in the decision-making process.

Budget simulations have had limited use in education due to their newness and costs. One of the most familiar is that developed by the National Education Finance Project and field-tested in Florida (Boardman, 1973). An evaluation by the Florida Education Research and Development Council was generally favorable and it endorsed the model for county use (Nickens, 1977). The model has also been adapted and used by other states (Johns, 1977).

Especially critical is the need for training with respect to budgets dealing with exceptional children. A simulation entitled "Monroe City: Finance Support Component Model" is available from the University Council for Educational Administrators for this purpose.

Stern (1978) has suggested that budget simulation be used to develop equalization formulas at the state level and in other phases of financial reform as well. In order to cut costs, the simulation could be maintained at the state level with school districts allowed access as needed. Stern also suggested that information from simulations could be supplied to legislators and interested citizens.

2. Strengths and Weaknesses

Strengths

1) Can serve as a forecasting and planning device.
2) Can satisfy external reporting requirements, eliminating budget amendments.
3) Can improve program efficiency.
4) Information generated can be used in collective bargaining.
5) Can save time in constructing the budget.
6) Can identify alternative funding strategies.
7) Can improve budget accuracy.
8) Can provide a detailed cost analysis and a cookbook procedure for program budgeting.
9) Could result in increased legislative responsiveness to school system needs.

Weaknesses

1) Start-up costs can be large.
2) Requires a specialized staff with a high degree of mathematical sophistication.
3) Simulation could fail to include sufficient information to make the proposed simulation adequately approximate reality.

Linear Programming

1. Description

Linear Programming (LP) is a mathematical technique designed to determine optimum allocation of limited resources when there are competing

demands. It is based on the assumption that all mathematical relationships in the model are linear (i.e., one variable is related proportionately to another variable). If one variable is related in a linear fashion to another variable, an increase or decrease in one of the variables will result in a proportional increase or decrease in the other variable. Sometimes the assumption of linearity is relaxed to allow its use with certain nonlinear elements, the assumption being that the elements approximate linearity enough in reality to make the assumption of linearity.

The objective in LP is the optimum allocation of resources given the existence of one or more constraints. There are an unlimited number of solutions to most LP problems. The task of the technique is to identify the optimum solution systematically and efficiently.

To be adaptable to an LP format, the problem under consideration must be concerned with either maximizing or minimizing a variable (Smythe and Johnson, 1966). Examples of educational variables that may fit a maximization framework include student achievement, facility utilization, teacher experience or instructional offerings. Administrators may wish to minimize variables such as student-teacher ratios, dropouts, transportation costs and number of unserved students. It is essential that the problem be properly formulated in these terms else the problem will not be solvable (Hentschke, 1975).

Variables to be included in an LP problem include quantities, efficiency measures and constraints. Quantity specifications answer the question "How much of what are we going to need?" In most educational settings, efficiency is measured in terms of least cost. Thus, a typical measure of efficiency is dollar cost. Constraints are sometimes thought of as resources. However, when limitations on their quantities are a significant dimension of a problem, they are referred to as constraints. For example, if the budget can accommodate only x number of teachers or x pieces of equipment, these are expressed as constraints.

The final and often most difficult phase in the formulation of LP problems is the assignment of numerical values to the problem variables.

The administrator/decision-maker must determine how much effect a unit of each decision variable has on the goal to be achieved. This is often difficult or impossible to do objectively. In such instances, administrators must rely on past experience and subjective judgment for an estimation.

In order to be solved, LP problems must be expressed algebraically to fit a predetermined formula and then solved by computer or by hand using a graphical method if the problem is not overly complex. The graphical method has practical value only with small-scale problems with two unknown variables and few constraints or vice versa.

LP is applicable to a variety of resource allocation problems depending on computer capabilities. Most LP problems are too complex to be solved by hand. Even a low-cost programmable calculator can handle only small-scale problems. Where more sophisticated computer facilities are available, LP is limited less by problem complexity, but the assumption of linearity still holds. Problems that deviate significantly from linearity are more suitable for other kinds of analyses such as dynamic programming.

Some attempts have been made to solve educational problems by adapting them to an LP model with varying degrees of success. LP has been applied to school problems such as staffing and personnel (Hentschke, 1975; Bruno, 1970), meal planning and school lunches (U.S. Dept. of Agriculture, 1966; Gue and Liggett, 1967), instructional program evaluation, and transportation problems (Tanner, 1971; Correa, 1975). Due to the intensely political nature of schools and other external variables not amenable to expression in LP terms, many analysts suggest more loosely applied programming as an alternative (Hentschke, 1975). Using this approach, one would search for the feasible alternative rather than the "optimum" one. The assumption is that there are variables that do not fit the typical LP formulation that are useful to problem-solving.

2. Strengths and Weaknesses

Strengths

1) Can deal with an infinite number of possible solutions to allocation problems.

2) Can identify an optimum solution from an infinite variety of alternatives in an efficient manner.

3) Supplies information concerning the value of resources that are allocated.

Weaknesses

1) Requires specialized training that most educational administrators do not have.

2) Mathematicians and computer facilities are generally required.

3) Output measures must either be singular or grouped in linear combination, an assumption which limits its application (Cohn and Morgan, 1978). Since most measures of educational output are multidimensional, a model accommodating only a single output would be of limited usefulness.

Goal Programming

1. Description

Goal Programming (GP) is a mathematical approach to decision-making widely used by economists and operations researchers. It deals with resource allocation problems and overcomes some of the limitations of Linear Programming (LP). The major difference in the two techniques is that GP accommodates multiple conflicting goals whereas Linear Programming cannot. The technique is designed to determine the optimum resource mix for the achievement of a set of educational goals.

GP assumes that goals can be ranked, based on their judged importance in the organization. High-order goals are considered first, and only then are low-order goals considered. It is suggested that ranking be conducted by group techniques such as the Nominal Group and the Delphi. Instead of attempting to maximize output as LP does, GP attempts to minimize deviations, both positive and negative, from the goals. Each goal is defined as one or more constraints, such as production variables (production within the constraint of what is possible), resource limitations, and nonnegativity (all variables must be either positive or zero). Administrators must declare which goals they are willing to underachieve as well as which ones they are willing to overachieve.

GP is more flexible than LP and is applicable to education problems which have multiple outputs, as most educational problems do. It is helpful if data can be obtained readily from school districts and technical expertise and computer facilities made available from state education departments if these are not available within the school district. To be of long-term value, the model must be rerun periodically, incorporating up-to-date data (Cohn and Morgan, 1978).

Applications of GP in education have been limited due to the high degree of mathematical sophistication necessary to apply the technique. Computer facilities are required and the procedure must be rerun fairly regularly in order to keep up-to-date with changing goals, technologies and constraints.

2. Strengths and Weaknesses

Strengths

1) Can accommodate a variable number of conflicting goals.

Weaknesses

1) Requires high level of mathematical sophistication and computer facilities.

V. CONCLUSION

The table which follows presents a summary of the resource allocation techniques selected for discussion. Each technique is evaluated according to five characteristics:

1. Information. What information does the technique provide? What product is the administrator left with once the technique has been used?

2. Effectiveness. How effective is the technique as a resource allocation device? To what degree does the technique do what it claims to do? What does current research say about its validity? How dependent are the outcomes of the technique on external variables beyond the control of the user?

TABLE 1. SUMMARY OF RESOURCE ALLOCATION TECHNIQUES

Characteristics	Cost-Benefit Analysis	Cost-Effectiveness Analysis	PPBS	Systems Analysis
Kind of Information	A ratio of benefits to costs of various alternative courses of action.	A ratio of effectiveness to costs of various alternative courses of action.	A program budgeting system. A list of activities designed to meet school's goals and objectives and an effectiveness/cost ratio for each.	Models of resource allocation alternatives.
Effectiveness	Powerful public relations and accountability device. More effective for policy formation than for school level resource allocation problems.	Powerful public relations and accountability device. Very effective as a resource allocation device if cost and effectiveness measures were skillfully derived.	If tied to a sound MIS and cost-effectiveness measures, can be an effective, long-term planning and support system for resource allocation.	Highly dependent on the skill of the person conducting the analysis. Omitting relevant components of the "system" greatly reduces the technique's effectiveness.
Flexibility	Some applicability to local educational settings and problems.	Applicable across a wide range of educational settings and problems.	Most applicable to large systems with highly developed MIS's and program budgeting and accounting capabilities.	Applicable across a wide range of educational settings and problems.
Complexity	Moderate	Moderate	Moderate	Low--becomes high if quantitative analyses are employed with the technique.
Resources				
Hours	High	High	High	Moderate
Funds	High	High	High	Low
Equipment	None	None	None (more successfully implemented with a computer).	None (can include computer use).

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Characteristics	MBO	PERT	Decision Matrices	Decision Trees
Kind of Information	A list of measurable goals and objectives and activities for individual personnel.	A graphical presentation of component project activities with time and cost projections for each.	A tabular presentation of decision alternatives and variables affecting them. Variables may be weighted in order to produce a rank-ordered list of decision alternatives.	A list of decision alternatives, probable outcomes of each and, in some instances, costs associated with each.
Effectiveness	Highly dependent on the administrator's ability to convey a commitment of personnel involvement and also on personnel's commitment to active involvement and follow through.	Highly dependent on accuracy of time and cost estimates fed into the analysis.	Dependent on the administrator's skill in identifying key variables impinging on decision alternatives.	Dependent on administrator's comprehensiveness in identifying relevant alternatives and supplying reasonable cost and probability estimates.
Flexibility	Applicable across a wide range of educational settings. Limited to personnel allocation problems.	Applicable to large, complex projects with at least 10 component activities.	Applicable across a wide range of educational settings and problems.	Most applicable to problems too complex for matrix presentation.
Complexity	Low	Moderate	Low	Moderate
Resources				
Hours	Moderate	Moderate	Low	Moderate
Funds	Low	Low	Low	Low
Equipment	None	Calculator (can include computer use).	None	None (can include computer use).

Characteristics	Budget Simulation	Linear Programming	Goal Programming
Kind of Information	A description of the projected impacts of alternative budget allocations.	A description of the optimum resource allocation alternative under specified constraints.	A description of the optimum combination of resources necessary to achieve a specified set of educational goals.
Effectiveness	Dependent on adequacy of MIS.	Technique is effective only for problems composed of variables that are linearly related to each other.	Validity of technique is highly dependent on the currency of the data used as input. The more dated the information fed into the analysis, the less effective the technique.
Flexibility	Applicable to systems that have computer access and for problems dealing with budget allocation alternatives.	Applicable mainly to systems that have computer access.	Applicable mainly to systems that have computer access.
Complexity	Moderate	High	High
Resources			
Hours	Moderate	Moderate	Moderate
Funds	Moderate	Moderate	Moderate
Equipment	Computer.	Computer usually required.	Computer usually required.

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3. Flexibility. Over what range of problems is the technique applicable? Is the technique equally usable in small and large school systems?

4. Complexity. How difficult is the technique to use? What knowledge and skills are required of the user? What level of mathematical sophistication is required in order to use the technique without outside assistance?

5. Resources. What are the resource requirements in terms of time (person hours), money and equipment? Are outside consultants/statisticians/operations researchers required?

The reader will observe from the table that the techniques' "complexity" and "resources" are evaluated along a continuum of high, moderate and low. These measures are defined as follows:

Complexity

1. High requires a high level of mathematical training and experience in order to implement the technique unassisted. The technique may be implemented by a technical specialist in collaboration with the administrator.

2. Moderate requires some advanced mathematical training and experience in order to implement the technique unassisted. Depending on the complexity and scale of the problem, it may require the assistance of a technical specialist in collaboration with the administrator.

3. Low requires little in the way of advanced mathematical training and preparation. It can be implemented by the administrator without assistance of a technical specialist.

Resources

1. Money

   a. High requires a large expenditure of funds in order to implement the technique. (The reader should bear in mind that many of these costly techniques can serve multiple purposes

such as evaluation, planning, reporting requirements, public relations and budget preparation. To the extent that this is true, the absolute cost of implementing the technique is less than if it served only one purpose.)

b. Moderate requires a moderate level of money expenditures for implementation. If the technique is used by the administrator unassisted, this often means a purchase of computer time. If the assistance of a technical specialist is required, costs may still fall in the moderate range unless the problem is large-scale, complex and excessively time-consuming.

c. Low requires little in the way of money expenditures. With some techniques where computer use is optional, the use of a computer will move the expenditure level to the moderate range.

2. Hours

a. High requires a large number of administrator hours and staff time for implementation. Techniques falling in this category typically require several months for successful completion.

b. Moderate requires a moderate number of administrator and staff hours for completion, typically less than a month.

c. Low requires a small number of administrator and staff hours for successful completion, typically less than one day.

Kind of Information

The kind of information provided by the techniques varies from a simple list of alternatives such as that supplied by MBO and decision matrices to a completely new way of accounting and record-keeping which may ultimately affect administrative structure (PPBS, for example). C-B and C-E analysis leave the administrator with a deceptively simple ratio which he/she must then interpret using other relevant qualitative information about the nature of the problem. Systems analysis may supply several products depending on the level of mathematical sophistication

employed in the analysis. The assumption that was made, for the purposes of the table, was that no mathematical analyses were employed. In that instance, the administrator is left with a number of models of decision alternatives and, more abstractly, with a new way of viewing problems (i.e., holistically rather than as a collection of isolated elements). Other techniques such as PERT, decision trees, LP, GP and budget simulation also leave the administrator with models and all of these are adaptable for computer use. For small-scale problems, all but budget simulation and GP can deliver models with just the aid of a desk calculator.

Effectiveness

All these techniques are as effective as the information from which their input derives. Assuming the information provided is adequate and complete, C-E analysis is probably the most effective technique for use by the local administrator in making choices among alternatives. The literature attests to its increasing popularity as a resource allocation device and its continued use is encouraged by many scholars in education. The effectiveness of other techniques such as PPBS, MBO and systems analysis are highly dependent on the administrator's skill, judgment and insight. In instances where the intent and purpose of these techniques were fully understood and accepted, they worked well. The literature is abundant with cases of failures in application where this was not the case.

Of the more heavily quantitative techniques, the literature favors GP as one of the most effective for resource allocation in an educational setting. Budget simulation has had favorable evaluations as well. LP is effective only for problems in which variables are proportionately related to each other, which is rarely the case in education. All these techniques have not been heavily researched and final judgment should await further investigations of their applications in educational settings.

Given limited time, decision matrices have proved to be a useful device for the administrator who must make a quick decision and justify it to county commissioners, the Board of Education, etc. The results, however, are largely dependent on the user's judgment since most of the data are supplied by the user rather than by the MIS.

Both PERT and decision trees have received favorable evaluations in the literature. PERT is limited in application to larger projects and decision trees have not been applied and researched extensively in education.

Probably the least appropriate technique for the local administrator is cost-benefit analysis. Although it has been quite effectively used for broad-level policy decisions, its practicality as a resource-allocation device for the local school administrator is questionable in its pure application. Some of its components, however, have been effectively incorporated into cost-effectiveness analysis and many of the combinations of the two techniques have received initial favorable evaluations in the literature. Several writers have encouraged school administrators to incorporate the concept of long-term costs and benefits from cost-benefit analysis when evaluating decision alternatives.

Flexibility

Of all the techniques discussed, the decision matrix is the one most adaptable to the widest range of educational problems. It is a technique so common in the management literature that it hardly needs mention. Yet, because of its simplicity, its value as a resource allocation device is often overlooked.

Likewise, MBO is a term quite familiar to most administrators and is adaptable to a wide range of educational settings. Sensational accounts of its failure, however, have made many administrators shy away from attempting to use it.

Cost-effectiveness analysis, decision trees and systems analysis, although still in their infancy in education, are applicable to a wide range of educational problems and settings. For complex problems requiring extensive computer time, decision trees and systems analysis are more adaptable to larger systems with computer facilities.

PERT is applicable to school systems of all sizes but is most appropriate for projects of a large-scale and complex nature. For exceptionally large and complex problems, computer facilities may be required.

Generally limited to school systems with computer capabilities are linear programming, goal programming and budget simulation. Linear programming has more restricted applications to problems whose variables are linearly related to each other.

Techniques most restricted in application are cost-benefit analysis and PPBS. As discussed earlier, cost-benefit analysis has greatest applicability in its pure form in broad policy decision situations. For systems desiring to change from traditional line-item budgeting to something more workable, PPBS is a reasonable alternative. It is probably unrealistic, however, to assume that all schools using line-item budgeting can and would be willing to implement the extensive changes necessary to switch to PPBS, especially in view of its widely publicized failures in some systems.

Complexity

The techniques discussed vary widely in complexity as can be seen from the table. Three techniques (decision matrices, systems analysis and MBO) are relatively simple and require little more than an understanding of how and when to apply them. When quantitative techniques are employed with systems analysis, however, it becomes highly complex.

Decision trees, cost-benefit analysis, cost-effectiveness analysis, PPBS, and PERT require a moderate level of sophistication in quantitative analysis and an ability to transform qualitative information into a quantitative framework. Equally important is the judgment required in identifying that information which is not, in its most useful form, quantifiable and the ability to use this information to support and "fine tune" the quantitative analyses.

Most complex are budget simulation, linear programming and goal programming. These all require a relatively high level of mathematical sophistication and familiarity with the computer. The alternative, of course, is to hire a technical specialist as a consultant in instances where the administrator lacks appropriate training.

Resources Required

Although not readily discernable from the table, some thought will likely lead the reader to conclude that the longer the time required to use a technique, the more costly it is. Such is clearly the case with the three most costly techniques: cost-benefit analysis, cost-effectiveness analysis and PPBS. The three most complex techniques--budget simulation, linear programming and goal programming--are moderate in terms of cost and time requirements largely due to computer costs and the time required to construct the models and programs. Low in cost and moderate in time requirements are decision trees, systems analysis, MBO and PERT. No special equipment is required for these with the exception of a calculator for PERT.

The least expensive technique is decision matrices; it is one of the most cost-effective depending on the nature of the problem under consideration. The reader should note that these resource estimates are highly variable and depend greatly on the accessibility of computer facilities and personnel available to perform computer and other quantitative analyses. In systems that have computer facilities and technical specialists either on the staff or readily available, costs of many of these techniques may be significantly less than in systems that do not have such support available.

In summary, it is clear from the literature that educational administrators are increasing their use of rational decision-making techniques and are becoming more comfortable with quantitative analyses as a way to cope with resource allocation problems. This trend is likely to escalate as accountability continues in emphasis and problems become too complex to handle with rule-of-thumb procedures and traditional judgment. Nowhere in the literature was there a technique for rational decision-making which could replace administrative judgment, nor is there likely to be one in the near future. To the administrator falls the task of coping with those "human factors" that are always a large component of any resource allocation problem. It is here that the "science" of administration and management becomes an art.

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APPENDIX A. REJECTED TECHNIQUES

Technique	Reason for Rejection
1. Cost-Efficiency Analysis	Requires an exacting level of measurement not suitable for most educational problems.
2. Monte Carlo	Too mathematically complex for practical application.
3. Queing Theory	Too mathematically complex for practical application; inappropriate for most educational problems.
4. Value Analysis	Most appropriate for business and industry.
5. Markov Analysis	Too time-consuming, expensive and mathematically complex for practical application.
6. Game Theory	Too mathematically complex for practical application.
7. Contextual Mapping	Too little information available.
8. Force Analysis	Too little information available.
9. Zero-Base Budgeting	Too cumbersome and time-consuming to be applied in an educational setting.
10. Bayesian Estimation	Too little information available.
11. Dynamic Programming	Too complex, time-consuming and costly for practical application.
12. Gantt Charting	Most salient and useful elements contained in PERT and MBO.
13. Input-Output Analysis	Rather than an entirely separate technique, it is a component of systems analysis.

Technique	Reason for Rejection
14. Regression Analysis	Useful only for limited kinds of educational problems.
15. Needs Assessment	More appropriate in the information-collection phase of a general planning effort rather than as a resource allocation device per se.
16. Consultation	More appropriate as an aid to resource allocation decisions rather than as a technique that stands alone.
17. Linear Responsibility Charting	Most salient elements expressed more thoroughly in MBO and PERT.
18. Survival Ratio Technique	Too inaccurate to be of practical use.

APPENDIX B

MANAGEMENT INFORMATION SYSTEMS

A Management Information System (MIS) is a means of capturing and organizing information in a form that is useful for decision-making. Although the term is usually associated with computers, many MIS's are manual. There are often cost and other administrative constraints which prohibit the use of computers in a school system although their use is increasing. Despite their increased use, there have been numerous problems in attempting to install workable MIS's in schools. In many instances, computerized systems have proved so unwieldy that they lie idle while the manual system that the school was already using is relied on instead (Ackoff, 1967; Mellor, 1977).

The decision as to whether to institute a computer-based or manual MIS in an educational system depends in part on the number of students served. A small school (serving under 500 students) may well find that a manual system serves its purposes quite well (Hostrop, 1975). As an alternative, many smaller schools are sharing computer facilities with larger schools in order to make computerized systems financially feasible. Ultimately an MIS should reduce administrative time in making decisions. If gathering the information, whether by computer or by hand, requires more time than an alternative method, the MIS is not only a poor investment but is unlikely to get much use. The information should also be available when needed. If administrators must wait several days or weeks for reports or summaries to arrive from a centralized location, either decision-making efficiency will decrease or the administrator will find another information source.

Where possible, MIS's should be used systemwide. This is not only economical (enabling time and cost-sharing by several school systems) but it provides a richer source of information for the decision-maker.

Schools do not operate in isolation and districtwide information is often needed by the local school administrator. Caution should be exercised, however, to ensure that the administrator is not overwhelmed with information that he/she will never use.

To be useful, the MIS should provide information to the administrator in a form that he/she can use. If significant time is required to interpret reports and aggregate or disaggregate data, the MIS likely will not receive maximum use. It has become customary to employ data-management specialists whose job is to intervene between the MIS and the administrator. Some argue that this practice only further alienates the administrator from the MIS by keeping him/her in ignorance (Ackoff, 1967), while others maintain that the "interpreter" role is critical and saves the administrator time and energy (Wyatt, 1975). Where there is close interaction between the data analysts and the users of the MIS both in the planning of the system and its use, many problems with the use of the interpreter are avoided (Hostrop, 1975).

Computer-based MIS's have been used in education since the early 1960's and are used increasingly as data needs have become greater (Hostrop, 1975). Still, the technology is rudimentary in education compared with business and industry. A recent study of vocational-education MIS's nationwide found that only six states had adequate or near-adequate data banks for cost analysis and program planning (Hale, 1978).

Foley and Harr (1972) suggest the following components for a workable educational MIS:

1) a finance-data file that includes cost information;
2) a staff-data file including demographic data, experience, ratings and salary levels;
3) a facility-data file containing facility characteristics, educational and other space characteristics, equipment specifications and program materials;
4) a pupil-data file containing student characteristics, standardized-test scores, and achievement data; and

5) a community-data file containing work-force characteristics, demographic data and other pertinent descriptive information.

In establishing an MIS, it is suggested that school systems study other school systems where MIS's have been implemented and from this study make adaptations to meet their unique requirements. Difficulties in establishing MIS's center more around human relations problems than the technical aspects of the system itself (Hostrop, 1975). Many difficulties here have been avoided by the development of English-like query languages that enable the administrator to use the system directly.

Although costs have been a barrier, time-sharing has proved feasible in some areas as well as large centralized systems such as OTIS (Oregon Total Information System). OTIS serves approximately 72 intermediate educational districts, public and private schools and agencies through 204 terminals and affects approximately 150,000 students (Mellor, 1977). The system was established in 1968 with the use of federal funds and is constantly revised to prevent its obsolescence.

GUIDELINES DOCUMENTS ON

ACHIEVING ACCESSIBILITY: FEDERAL LEVEL

by

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I. INTRODUCTION

Accessibility is one of the most important issues in education today. School and college administrators are all aware that under the law their programs must be made accessible to disabled people, but many of them are confused or frustrated when they try to find out both what must be done and how to do it.

The vocational education administrator who is trying to comply with various legal requirements for providing equal educational opportunities will be looking for useful guidelines on making buildings, facilities and programs accessible. Generally, they will find that such guideline documents are difficult to find, inappropriate, and require considerable previous experience or in-depth knowledge of the requirements of architectural accessibility in order to apply them to educational facilities.

Goals and Objectives

The basic question addressed in this state-of-the-arts review is "What is the general nature of the guidelines and guideline documents available to the local school administrator related to the removal of barriers to access?" The more specific objectives are:

1) Identify the federal guideline documents that (a) have been/are being used by educators and (b) more importantly, are available for use by educators in addressing the question of program accessibility.

2) Comment (analyze) on the types and character of guideline documents available.

3) Identify and note the documents and information that must be taken into account when constructing the user's manual.

II. METHODOLOGY

The most complete bibliography on accessibility issues is the Resource Guide to Literature on Barrier Free Environments published by the Architectural and Transportation Barriers Compliance Board. Project staff are thoroughly

aware of or have reviewed within the past two years 90 to 95 percent of the documents listed in that bibliography which relate to providing accessible physical facilities. Staff have also reviewed most new publications in the field as they have become available since the publication of that bibliography.

Revised federal facility and program accessibility documents include: (1) Office of Civil Rights guides and information on Section 504 of P.L. 93-112 on program accessibility; (2) The American National Standards Institute A117.1 Specifications for Making Buildings and Facilities Accessbile to, and Usable by, the Physically Handicapped (ANSI, A117.1); (3) the Veterans Administration Standard; (4) the Corps of Engineers Standard; (5) the HEW Construction Standard; and (6) the Civil Service Commission Guidelines. Four of these documents had restricted applicability for school settings; two documents, the Office of Civil Rights information and the ANSI A117.1 code, proved of major importance to the specific task. However, taken together, the documents have several important applications for the work project.

III. CURRENT STATE-OF-THE-ART

Among the various types of guideline documents, some are mandatory minimal accessibility building standards required by various state and federal laws and regulations. Others that might be more useful as guidelines are building code documents; these are mandatory in the states or regions where they have been adopted by regulatory agencies and, although they will not be mandatory elsewhere, they can often be helpful references. Still others are commercial publications, publications of service organizations, and research reports.

In discussing some of the various guideline documents available, one must understand which are mandatory compliance standards under the various applicable laws and which are non-mandatory but useful reference documents. In addition, one must consider the relationship of these documents to the law, the adequacy of their coverage of the requirements for physical accessibility, the applicability of the material to educational facilities and the general usefulness of the document for the administrator or non-expert in design.

The two most important laws affecting vocational education facilities and programs are the Architectural Barriers Act of 1968 (P.L. 90-480), and Section 504 of the Rehabilitation Act of 1973 (P.L. 93-112). The significant difference between these two acts is that the Architectural Barriers Act covers federally funded facilities and Section 504 covers federally assisted programs.

Facility accessibility is required under P.L. 90-480 for any building constructed or leased with federal money since 1969. Facility accessibility under P.L. 90-480 means compliance with the American National Standards Institute A117.1 Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped (ANSI Standard). It is available from the American National Standards Institute in New York and from the National Easter Seal Society in Chicago.

Program accessibility as required by Section 504 means that all federally assisted programs and services offered by an educational institution must, when viewed in their entirety, be accessible to disabled people. Program accessibility does not necessarily require building accessibility.

Program accessibility can frequently be achieved by such means as rescheduling classes, assigning interpreters, modifying a piece of equipment, and so forth. Program accessibility can also be accomplished by making buildings accessible; when this method is chosen, Section 504 requires the degree of accessibility to be equal to that dictated by the ANSI A117.1.

Using physical accessibility as a means for achieving program accessibility does not mean that all areas of every building and facility must be made accessible; however, it does mean that there must be access to all programs. For example, program accessibility does not mean that every chemistry laboratory must be physically accessible; it does mean that enough laboratories must be barrier free in order to ensure that a disabled student could take all the courses offered in the chemistry program.

A more detailed explanation of program accessibility and other 504 requirements can be found in publications from the Office for Civil Rights, including the Guide to the Section 504 Self-Evaluation for Colleges and Universities, and the Guide to the Section 504 Self-Evaluation for Elementary,

Secondary and Adult Education, and in publications from the Association of Physical Plant Administrators (APPA) such as Planning for Accessibility and particularly Creating an Accessible Campus.

The Office of Civil Rights Guide is primarily a planning document. The introductory letter stresses that it is not a rule book but a set of "suggestions" for achieving compliance with Section 504. It is not intended to be comprehensive, and cautions its readers "... that certain actions suggested in this Guide may not be appropriate for their institution, while others that do not appear in this Guide may be necessary for compliance with Section 504." The purpose of the Guide is "to provide a process that will enable individuals to organize effectively and identify easily those areas in their institutions that require evaluation."

The Guide contains a thorough explanation of the Section 504 regulations as they apply to colleges and universities. There are sections on General Provisions, Key Terms, General Actions; Program Accessibility; Student Programs, Activities, and Services; and Employment; all of which include the appropriate section of the regulations, a discussion and analysis, and a good self-evaluation form. However, the Guide's emphasis on process rather than specific how-to information makes it less useful in the area of architectural accessibility. For example, Section 504:84.22 (e) Transition Plan of the 504 Regulations requires that all recipients have on file and available for public inspection a plan for removing architectural barriers where structural changes are necessary for program accessibility. This plan should have been completed by December 1977, only six months after the publication of the regulations. This short period of time did not allow for the development of technical assistance materials on barriers identification and removal. Although HEW funded a few projects to develop material on physical accessibility, most notably the HEATH Projects, no technical assistance material on architectural accessiblity has been produced comparable to that being put out on program accessibility and other aspects of 504 compliance.

One of the weakest parts of the Guide is its assumption that:

> "... colleges and universities completed their Transition Plans by December 2, 1977, and have formal plans for the modification or renovation of facilities. This Guide, therefore, makes no attempt to provide information regarding the identification and removal of physical barriers."

The Office of Civil Rights is in a delicate position on this issue as they can hardly admit that what was required by the law has not been done; yet to completely ignore the needs of the recipients, many of whom have not completed or must update or modify their Transition Plans, is to be less than helpful. Although the Guide does admit that some institutions might still be "... in need of such information or wish to refine their Transition Plans ...," the only suggestions given are a "list of organizations and literature that may be helpful with regard to facility modification efforts," and two publications which will be discussed later--Architectural Accessibility for the Disabled of College Campuses and Locating an Accessible Campus.

Where architectural accessibility is discussed, the self-evaluation directions for the Transition Plan state:

> "List any buildings or facilities that have been constructed since September 2, 1969, with federal construction funds. In each case indicate whether or not such buildings or facilities have been constructed in accordance with ANSI Standards. For those buildings listed that were not constructed in accordance with ANSI Standards, indicate immediate steps that will be taken to ensure that necessary modifications are made."

While such language tells the administrator what they must do, it does not offer any suggestions about how the process must be done. Since the ANSI Standard is required by both P.L. 90-480 and Section 504 as the standard for physical accessibility, and is the most important document available to school administrators, it is important to understand just what it is and how it was developed.

Standards, in general, are guidelines or recommendations for design which are intended to aid the manufacturer, the consumer, and the general public by standardizing design practices. Regulating the design of virtually anything, practices and procedures are usually established by voluntary groups.

Organizations such as the private American National Standard Institute (ANSI) bring together professional people and experts to write standards in their area of concern, and then submit the standard to a committee vote. These standards are only voluntary or recommended practices and procedures and do not have enforcement or legislative authority until they are adopted by a body or agency which has such authority.

The ANSI Standard on accessibility was developed in 1961 and was voted on by an extensive committee of industry representatives. When it was specified by several federal and state laws, its requirements for accessibility became mandatory under those laws.

Between the completion of development of the Standard in 1961 and the present, certain deficiencies in its content have become apparent including the following:

1) It has almost no provisions for people with certain types of disabilities such as deafness.

2) It is not specific in certain technical design requirements such as those for audible and visual warnings, or those for "abrupt changes in level."

3) It does not include provisions for housing.

4) It provides only dimensional specifications for a very limited number of architectural features and, like all standards, it does not tell the user how many of each type of feature must be made accessible nor where these features must be located. These decisions have been left up to the agencies adopting the Standard and in the case of P.L. 90-480 and Section 504, no such applications or guidelines have been provided.

These deficiencies in the original (1961) Standard have long been recognized and are documented in the General Accounting Office study report of 1975. As a result, the ANSI Standard is undergoing an extensive revision. The new version will cover many areas formerly omitted, will give more extensive, detailed technical information in the specifications, and will be presented in a more usable format. However, as a national standard it still will not specify the minimum number of each accessible feature required, as this remains the job of the adopting agency.

Until the completion and adoption of this revised version, the 1961 ANSI is still the Standard which educational institutions must use to bring their programs and facilities into compliance with the law. One of the greatest disadvantages of the ANSI Standard is that its requirements are so minimal that it is possible for a building to comply with it and still in large part be inaccessible to handicapped people. Thus a building constructed in compliance with the Architectural Barriers Act of 1968 may still need to be modified to achieve program accessibility. This is so because neither ANSI nor the law specifies how many or where accessibility features should be included. As a reference document for school administrators, copies of ANSI will only provide specifications for accessible building features and will not provide any application guidelines.

Although ANSI is the "bottom line" standard required under P.L. 90-480 and Section 504, there are other standards and codes which may apply to educational institution building construction, or may be helpful to the administrator in trying to understand and implement ANSI. Most federal agencies which are involved in construction have their own building regulations which apply to any construction in which agency funds are involved. (The Architectural Barriers Act applies to construction using any federal money.) Thus, a school or hospital built with HEW funds would have to comply with the HEW agency building standard which, in this case, is the HEW Technical Handbook, and, of course, with ANSI under the Architectural Barriers Act (P.L. 90-480). It should be noted that this and most other agency standards are based upon ANSI and have been expanded or modified to meet the specific agency facility building requirements, to include some of the omissions in the original ANSI, and often to specify minimum numbers of features.

On the whole these agency standards have been more useful in specific situations as guidelines than ANSI. They are usually illustrated and contain more comprehensive specifications, but they do not offer much assistance in applying the technical specifications. In addition, both the agency standards and ANSI have been developed for new construction and do not give any alternative recommendations which may be appropriate for modifications to existing facilities. Further, sometimes when more than one standard applies, the result can be confusion if not contradiction.

In addition to being covered by ANSI and applicable federal agency regulations, educational institution construction must also comply with state and local building codes. Every state has passed some legislation providing for accessibility in buildings. Some states have simply adopted ANSI. Others have developed much more extensive building regulations for accessibility. The more extensive state codes are often much broader in scope, specify application and minimum numbers or percentages, provide more background information about the reasons for the requirements, and may offer alternative design solutions for modifications to existing facilities. Several state code regulatory agencies have published elaborate manuals on their requirements which include illustrations and explanations of the specifications. Some of the more useful include Illinois, Washington State, Massachusetts, Ohio, North Carolina, and New Mexico. These documents may be very useful as guidelines, but one must be careful to compare them with ANSI to be certain that all mandatory requirements of P.L. 90-480 and Section 504 are included. Usually these state codes exceed ANSI in the degree of accessibility required.

In addition to individual state codes, there are four model building codes in the United States (the Standard Building Code, the Uniform Building Code, the Basic Building Code, and the National Building Code) issued by different national groups associated with the building industry. In recent years they have been modified to include provisions for accessibility. These model codes may be adopted by any state or other regulatory agency, and many states have done so without making any modifications. The model code documents are available from each issuing body but, like standards, they are only mandatory where they are required by law. As supplementary guidelines, they provide little additional information.

Another source of good design information which may be useful to vocational education administrators is publications which are produced as part of federally funded research projects. These publications concentrate on a single topic such as barrier free site design, mobile home adaptation for handicapped people, or furniture selection for use by handicapped and able-bodied people, and they almost always present a well-illustrated and in-depth treatment of the topic addressed. The information in these documents can be most useful to an administrator and his staff in determining the

kinds of physical features which may be necessary to accommodate people who are disabled. Their usefulness as guidelines for decision making is limited only by the fact that they may provide too much information without establishing any method for setting priorities and that they each address a single topic and not the total environment which the school administrator must consider.

Some commercial publications provide a rather comprehensive treatment of physical features necessary to accommodate disabled people. One disadvantage of these documents is that their content is generally the product of an individual author's experience and opinion. Consequently, they may not represent the consensus on important issues and they may not include recommendations compatible with the mandatory requirements of P.L. 90-480 and Section 504.

Other documents which may be helpful as guidelines are those published by membership or service organizations as aids to their members or constituents. Documents such as the APPA publication mentioned above, Creating an Accessible Campus, and Housing for the Handicapped and Disabled, published for the National Association of Housing and Redevelopment Officials, generally contain sound advice on making facilities accessible, and in some instances attempt to provide guidelines on establishing appropriate numbers of facilities to make accessible. These publications often relate the experience of the organization's members in developing accessible facilities. This experience varies widely, takes place under different jurisdictions and may not be easily generalized.

There are only a few guideline documents which directly address modifications to existing facilities. Two of these are Accessibility Modifications published by the North Carolina Department of Insurance and Architectural Accessibility for the Disabled of College Campuses from the New York State University Construction Fund. The North Carolina document was developed to assist administrators in modifying their facilities for accessibility and offers advice which is based primarily on the North Carolina building code requirements for the handicapped. These documents may be useful to vocational education administrators, but, inasmuch as they are state standards and based upon a state code, they must be used with the same caution about ANSI compatibility as given for the use of any state code.

Of the documents mentioned above, the best technical help available is found in the publications referenced by the OCR Guide: Architectural Accessibility for the Disabled of College Campuses and in the publications of APPA of which Creating an Accessibility Campus is the newest and most complete. These publications are, in fact, two of the most useful ones around, but neither of them is the definitive work on barrier identification and removal for educational institutions.

Architectural Accessibility for the Disabled of College Campuses was developed by the New York State University Construction Fund for use within the university system and is based on their extensive experience in modifying their statewide university system standards for accessibility. It is an exceptionally informative document since it contains not only thoroughly illustrated design criteria but also the "rationale" for the selection of those criteria and "policy" statements suggesting non-architectural planning and administrative policies which would increase accessibility. The design information in Architectural Accessibility is excellent in terms of scope and the degree of accessibility provided, and application of the criteria would almost always be equivalent to or exceed the ANSI Standard and therefore be acceptable for construction or modifications complying with P.L. 90-480 and Section 504. However, it is not based on ANSI and does not give administrators the minimum requirements with which they must comply under the law. As a supplementary document for increased accessibility and additional design requirements for educational facilities and spaces, it is excellent.

Creating an Accessible Campus contains both Section 504 compliance material and technical assistance. The chapter on "Program Accessibility and Section 504" was written in part by the author of the OCR Guide and is really a condensed version of the discussion and analysis material found in that book. Creating an Accessible Campus does not have the prototype self-evaluation forms found in the Guide, but it does offer much more information on architectural accessibility. There is a chapter on "Facilities Inventory, Survey and Evaluation" which makes many good suggestions on conducting accessibility surveys and includes two sample campus survey forms. Specific design

information is given in the chapter, "Designing for Accessibility," which includes recommendations for modifying existing facilities. The recommendations are based on the ANSI Standard, but not all the requirements are presented and the exact ANSI language is not used. Most importantly, some of the recommendations are inaccurate. The material is useful but is probably best suited to writing a Transition Plan rather than implementing one. More technical information is provided in the chapters on "Special Considerations for Special Spaces," "The Handicapped Student in the Science Laboratory," and "Instructional Aids for Program Accessibility." The latter is a good listing of available products which can help provide accessibility.

Given copies of the ANSI Standard, the OCR Guide, and the SUNY and APPA books, one might have the necessary information to comply with Section 504 and achieve physical accessibility. However, the amount of time it would take to (1) sort through these documents; (2) discover the applicable material; (3) organize it; (4) develop forms for vocational education facilities; (5) conduct the survey; (6) evaluate the information; (7) create a plan; and (8) carry out the plan would be staggering. Most of the information is there, but it is not in usable form.

Many institutions and organizations have developed facility inventory surveys which are used to determine the degree of accessibility or inaccessibility of buildings and to provide guidance for modifications. To date no analysis of these survey instruments has been made and although the concept of such a survey may be valid to assist administrators, no estimate of the usefulness of any of the available surveys can be given at this time.

Some institutions, such as Gallaudet College in Washington, D.C., and St. Andrews Presbyterian College in Laurinburg, North Carolina, have had extensive experience in providing services for people with particular disabilities. These institutions have developed methods and procedures which have been tested through their practical application on their campuses. The physical plant administrators of those institutions often have information available which can be of considerable assistance to others in accommodating similarly disabled people.

IV. SUMMARY

In summary, the information which could provide guidance for the vocational education administrator in making facilities and programs accessible can be characterized as follows: (1) it comes from widely differing sources; (2) it has been developed under different jurisdictions; (3) it contains recommendations which frequently differ with or contradict each other; (4) it may require considerable expertise to determine appropriate solutions to accessibility problems and to establish appropriate priorities for their use; (5) it may be outdated; and (6) in terms of program accessibility and the planning process, little assistance is available. Most experts on accessibility agree that what is needed are (1) completion and universal adoption of the revised ANSI A117.1 National Standard, (2) related applications manuals, and (3) training programs on the use of the standard and the manuals. A new, comprehensive national standard which could be incorporated into the existing laws by Congress, adopted by federal agencies as their regulatory standard, and adopted by states for their building codes would give the uniformity which is so acutely needed now.

As mentioned earlier in this paper, the ANSI A117.1 Standard is undergoing extensive revision at this time. It is the hope of all concerned that the new ANSI A117.1 will become the uniform standard recognized as necessary for effective implementation of accessibility programs. The new ANSI Standard should be completed within the next year and, it is hoped, sooner. When completed, it will be a broader standard presented in a more usable format and containing useful information for those developing compliance programs. When it does become available as a national standard, the adoption process will require additional time. Even when such a universal standard is available, each program area will still require specific guidance on the application of the standard in their field.

For example, ANSI will state that for each type of feature to be made accessible, "a reasonable number but always at least one (of each feature in question) must be provided which meets the requirements of this standard"

(ANSI A117.1 1979). Those responsible for implementing accessibility programs will at the very least require some guidance on what is an appropriate number for a given set of circumstances or what procedures must be applied to determine "reasonable number." An applications manual could provide this type of guideline information in addition to methods for identifying barriers, alternative ways to modify facilities, and procedures for establishing priorities for modifications. It is also clear that the administrators of vocational education programs could provide more effectively and economically for disabled people in their programs if they had a single source of guidance specifically oriented to their type of programs. There is a definite and urgent need for this type of document.

The most effective way of complying and explaining the information in a standard and an applications manual is through a training program. In this way, detailed requirements and specific applications can be thoroughly explored, and individual questions and problems can be examined. A training program makes expert advice available to many people at once, and trainees having completed the program would be better equipped to deal with the problems of implementing accessibility requirements.

One additional weakness of the current information on physical accessibility is transportation. Most of the guideline documents discussed deal with the physical accessibility of buildings and sites and in some instances equipment and furnishings. There are no recommended guideline documents known to us at this time which cover transportation of disabled students. It is known that many institutions have developed their own transportation systems for this population and that there has been, in some instances, as much as 20 years experience with the operation of such systems. Yet documentation of methods and procedures employed seems to be scarce.

In this paper we have discussed available guideline documents which may be useful to vocational education administrators in making their programs and facilities accessible to disabled people. It is apparent that the greatest need is for the adoption of a uniform national standard; but the immediate need of vocational education administrators is for a guide to help them in three ways: (1) to pick their way through the maze of standards and understand how

the standards apply to their particular environmental problems; (2) to provide for a planning process which includes physical accessibility about which there is a great deal of information and program accessibility about which there is little information; (3) to help them understand compliance in terms of state and federal laws, regulations and guidelines; and (4) to suggest some possible solutions.

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